VII. INFLUENCE OF EXISTING MANAGEMENT EFFORTS

Disease

State statute and code provide authority to the Department to curtail or minimize the impact of diseases on fish, amphibians and aquatic invertebrates within California. Implementation of this authority is achieved through: 1) inspecting imported fish and aquatic species or their gametes obtained from other states and countries; 2) inspecting aquatic species raised in state, private, and cooperative hatcheries prior to approval for planting into public waters; 3) inspecting wild fish and aquatic species captured for transport to a different location; 4) inspecting wild fish and aquatic species to acquire information, useful for fishery management decisions, on the geographical distribution of pathogens; and 5) recommending therapies and corrective measures, or stock destruction to minimize disease impacts.

Regulations granting authority to protect the state's resources from fish diseases and parasites are contained in the FGC (CFGC 2002), and the California Code of Regulations, Title 14 (Title 14). Most of these regulations are directed toward private individuals and aquaculture operations, but they also apply to state and federal hatcheries and cooperative rearing programs. The authority to curtail the spread of disease is located in the following sections of the FGC:

- Section 1008 - investigation of disease;
- Section 1174 - conditions regarding private nonprofit hatcheries;
- Sections 6300 through 6306 - infected or diseased fish;
- Section 6400 - prohibits placing fish without Department authorization;
- Sections 15500 through15516 - disease control.

Title 14 states the procedures for aquaculture diseases control. The regulations on aquaculture can be found in chapter 9, sections 236, 238.5, and 245. Section 238.5 deals with stocking of aquaculture products. This regulation covers proper licensing, permitting, exceptions and restrictions to stocking.

In section 245, the regulations are split into three parts: a) general conditions; b) definitions; and c) disease categories. These regulations are applied to protect aquaculture and the watersheds or geographic areas the Department determines could be threatened. General conditions deals with procedural guidelines. These guidelines involve:

- inspections and examinations, and how they are to be conducted;
- who is notified if a listed disease is identified;
- what to do upon confirmation of any listed disease;
- methods of disposal, and disinfection of equipment and facilities;
- certification, by a fish pathologist, prior to shipment from outside of the United States;
- disease research and who is contacted prior to the causative agent being brought to the facility.

Disease categories are broken down into four groups by level of threat. These categories are: significant diseases, serious diseases, catastrophic diseases, and "Q" diseases (a disease for which there is so little information, permanent classification cannot be given). Each group has a

list of diseases, and procedures to follow for each disease. Also contained in the regulations is a list of aquatic diseases and their host organisms.

The above procedures, regulations and codes are designed primarily to benefit hatchery fish, but also to curtail the spread of diseases that may be inherent in hatchery populations to wild fish. Depending on the disease category, diseased fish are not to be stocked in waters where the disease is not known to occur. These steps should prevent the unnatural spread, or introduction of, diseases to non-infected waters of the state.

BKD is one of the more serious diseases affecting coho salmon in hatcheries. In the California portion of the SONCC Coho ESU, only Trinity River Hatchery has experienced problems with BKD (Mel Willis, pers. comm.), although Trinity River, Mad River, and Iron Gate hatcheries all spawn some infected adults. The problem was so severe at Trinity River Hatchery that a program to reduce infection from vertical transmission was implemented in 1991. This program involves taking ovarian fluid from each female spawned, assigning a number to the eggs, and keeping them separate until the eyed stage. The ovarian fluid is examined by the flourescent antibody technique, which uses a flourescent tagged antibody that reacts with the bacteria. Eggs from samples found to be positive are discarded. This type of program has not been necessary at either Mad River or Iron Gate hatcheries.

There have been no BKD problems in the coho production at Trinity River Hatchery since this program was implemented (Mel Willis, pers. comm.). At the start of the program, approximately 15% of the returning fish were infected with BKD. The level of infection ranged from low to severe. In recent years, less than 2% of returning fish are infected at low levels.

This program has been beneficial in allowing the hatchery to raise coho salmon free of BKD. Natural stocks are likely infected since BKD is a naturally occurring pathogen. However, this program is likely affecting wild stocks as well since the hatchery is not releasing infected fish and adding to the pathogen level in the river. The fact that the BKD level has dropped substantially in returning fish suggests the same may be true for natural stocks, especially in cases where hatchery and natural fish may interbreed.

Disease does not cause significant coho mortalities in Department hatcheries in the SONCC Coho ESU (Mel Willis, pers. comm.). BKD was the most problematic but is now being controlled with the above mentioned program. Other bacterial diseases, namely cold water disease, occur infrequently and are treated on a case by case basis with antibiotics added to the feed.

Hatchery Operations

Hatchery Production

California has a long history of coho salmon artificial propagation that dates at least to the 1890s (NMFS 2001a). Hatchery-produced coho salmon have been collected and planted in most, if not all, of the larger coho salmon-bearing waters of the state (Brown and Moyle 1991). Brown and Moyle (1991) conclude that all long-run coho salmon stocks, except the Eel River stock, were dominated by hatchery production. Seven facilities, consisting of private (i.e. cooperative)

and State hatcheries, and an egg taking station, have recently produced coho salmon in California (Table 18).

A few facilities once produced coho salmon, but have not been active for some time. Silver King, an ocean salmon farming facility near Waddell Creek, produced an average of 95,094 coho salmon in 1984-85 (Streig 1991, as cited in Weitkamp et al. 1995). Prairie Creek Hatchery produced an average of 89,009 coho salmon from 1987/88 to 1990/91 (NRC 1995, as cited in Weitkamp et al. 1995). Prairie Creek Hatchery was closed in 1992. Humboldt Fish Action Council (Cochran Ponds) produced an average of 35,931 coho salmon in 1987/88 (Hull et al. 1989, as cited in Weitkamp et al. 1995).

Coho salmon production at many private North Coast facilities has been curtailed by the Department since coho salmon became listed under the ESA. Coho salmon production has not been permitted in recent trapping and rearing permits issued by the Department during 2000 for several of these operations.

In general, California hatcheries have released far fewer coho salmon than hatcheries in Oregon and Washington. NMFS (2001a) and Weitkamp et al. (1995) estimated that coho salmon production between 1987-91 (Table 19) in the CCC Coho ESU comprised less than 0.3% of coastwide releases. Releases in the California portion of the SONCC Coho ESU amounted to less than 1% of the coastwide coho salmon hatchery production.

Production of coho salmon at California facilities has drastically decreased in recent years (Table 19). Recent average production at Warm Springs, Mad River, and Iron Gate Hatcheries, and Noyo Egg Taking Station ranges from 11% to 44% of the average between 1987-91. Average recent production at the single private facility still in operation, Big Creek Hatchery, is only 22% of the five-year average between 1987-91. Releases from Big Creek Hatchery between 1996 and 2000 have been highly variable and dependent on spawner availability, ranging from 0 (BY 96/97) to around 25,000 (BY 95/96) fish released. Trinity River Hatchery is the only California coho salmon production facility to have maintained production at recent historical levels: average production between 1997-2001 was 106% of average production between 1987-91.

Iron Gate and Trinity River hatcheries have generally met their spawner quotas between 1997 and 2001. In several facilities, lack of spawners is the single factor most commonly responsible for limiting coho salmon artificial production in California (Weitkamp et al. 1995). At the time of this review, hatchery coho salmon production at several facilities has been severely curtailed or terminated for this reason. Big Creek Hatchery's production has been highly variable. In several years, number of spawners was limiting. This may be due largely to there being only one viable brood year lineage in the source population in Scott Creek (Dave Streig pers. comm.). In the years between 1994 and 1999 when coho salmon were spawned, Big Creek Hatchery used very small numbers of spawners (5 to19 females per year and 7 to 22 males per year) as broodstock. This hatchery program is in the process of being converted to a captive broodstock program under direction of NMFS' Southwest Fisheries Science Center.

Warm Springs Hatchery has not produced coho salmon in the last three years because of low spawner abundance (e.g. 2 to 3 returns in 1999/00, no returns in 2000/01). It is currently developing a captive broodstock program for restoration of the Russian River coho salmon using

broodstock from a variety of sources in the Russian River and Marin County streams. The Noyo and Rowdy Creek facilities did not produce coho salmon in 1999 or 2000 due to lack of spawners. However, coho salmon did return to Rowdy Creek Hatchery in 2001 (Bob Will, pers. comm.). Mad River and Iron Gate hatcheries have drastically reduced production in recent years. Iron Gate Hatchery reductions have been due to decreases in production goals. However, weak returns during the 1999 brood year resulted in the hatchery not quite meeting production goals (46,254 yearlings produced out of a target of 75,000). Coho salmon production at Mad River Hatchery was terminated in 1999 by management decision. The hatchery may develop a role in assisting coho salmon recovery. In the last two years Rowdy Creek Hatchery has not taken any coho salmon spawners (Jerry Ayers, pers. comm.).

Table 18. Recent coho salmon artificial production facilities in California.

Facility Name	Operator	Type of Facility	Stream	Location (County)	ESU	Ops. Began
Big Creek Hatchery	Private [p]	Cooperative Enhancement	Big Creek (Tributary to Scott Creek)	Santa Cruz	CCC	1986
Warm Springs Hatchery	CDFG	Mitigation/ Conservation	Dry Creek (Tributary to Russian River)	Sonoma	CCC	1970
Noyo Egg Taking Station	CDFG	Enhancement	South Fork Noyo River	Mendocino	CCC	1962
Mad River Hatchery	CDFG	Enhancement	Mad River	Humboldt	SONCC	1970
Trinity River Hatchery	CDFG	Mitigation	Trinity River	Trinity	SONCC	1958
Iron Gate Hatchery	CDFG	Mitigation	Klamath River	Siskiyou	SONCC	1965
Rowdy Creek Hatchery	Private	Cooperative Enhancement	Rowdy Creek (Tributary to Smith River)	Del Norte	SONCC	1972

[p] Monterey Bay Salmon and Trout Project

Table 19. Comparison of coho salmon artificial production (average number of fish released annually) at recently active California facilities.

Facility	ESU	5-year Average 1987-1991[q]	Most recent 5-year Average (years)[r]
Big Creek Hatchery	CCC	26,808	5,883[s] (1996-2000)
Warm Springs Hatchery	CCC	138,208	14,527 [t] (1997-2001)
Noyo Egg Taking Station	CCC	170,171	55,604 [u] (1994-1998)
Mad River Hatchery	SONCC	370,907	134,870 (1995-1999)
Trinity River Hatchery	SONCC	496,807	525,512 (1997-2001)
Iron Gate Hatchery	SONCC	160,193	70,954 (1997-2001)

[q] 5-year average 1987-1991 (CDFG unpubl. data)
[r] (CDFG unpubl. data)
[s] Production = 0 in 1998 included in average.
[t] Production = 0 in 1999, 2000, 2001 included in average.
[u] Production = 0 in 1995, included in average.

Only Iron Gate and Trinity River hatcheries are currently producing relatively large numbers of coho salmon consistently. Iron Gate has a production goal of 75,000 coho salmon yearlings per year. However, this is only about 44% of the hatchery's 5-year average annual production between 1987 and 1991 (Table 19). The most recent hatchery release consisted of 46,254 brood-year 1999 yearlings, which were released into the Klamath River at the hatchery. All of these were marked with left maxillary clips.

Trinity River Hatchery produces the largest number of coho salmon of any California facility. Most of the coho salmon returning to the Trinity River are thought to be of hatchery origin. Although natural production of coho salmon occurs in the mainstem Trinity River and several tributaries, in-river spawners upstream of the South Fork Trinity River confluence are dominated by Trinity River Hatchery strays (85% to 95% for the years 1997 through 2001; Wade Sinnen pers. comm.). Trinity River Hatchery's annual production goal is 500,000 coho salmon yearlings. The current production goal is similar to both 5-year averages shown in Table 19. The brood year 1999 production consisted of 513,400 coho salmon, all with right maxillary clips, which were volitionally released at the hatchery.

Source Stocks and Stock Transfers

Stock transfer and source stock data over the history of coho salmon artificial production in California are sufficient to indicate patterns from which limited conclusions can be drawn. Planting records for private production facilities are incomplete (Weitkamp et al. 1995). The available information, based on Department and private hatchery records and published reviews, is summarized below.

Between brood years 1986-87 and 1994-95, Big Creek Hatchery frequently included broodstock from the Noyo River and Prairie Creek in its coho salmon production. This practice was terminated after 1994. Also, in the 1970s Waddell Creek was likely planted with coho salmon from Washington and other places by a commercial ocean farming operation (Taylor 1991; Brown et al. 1994).

Eggs collected at Noyo Egg Taking Station are reared to yearlings at Mad River Hatchery. These yearlings are then planted in the Noyo River with the object of maintaining the run to the station. Since 1976, yearling coho salmon planted in the Noyo River have all been from Noyo River coho eggs. Between 1967 and 1975, the majority of coho salmon planted in the Noyo River were from Noyo River coho salmon eggs with only one year when the source is listed as Trinity River. Between 1962 and 1967, coho salmon stocked in the Noyo River were from a mix of Noyo, Pudding Creek, Alsea (Oregon), and Klaskanine (Oregon) egg sources. Single sources tended to dominate the source stock for any given year during this time. Coho salmon from Noyo River broodstock were also occasionally planted in various other locations (Brown et al. 1994).

Prior to 1971, coho salmon returns to Trinity River Hatchery were about 1,000 fish. Coho salmon returns in subsequent years have varied greatly, but are generally more than 1,000 fish. Annual returns of over 5,000 coho salmon occurred in 1973 and between 1984 and 1988. Over 10,000 coho salmon returned in 1988, and over 20,000 returned in 1987. Between 1963 and 1969, Trinity River Hatchery received stock from the Eel, Noyo, Klaskanine (Oregon), and Alsea (Oregon) rivers.

Iron Gate Hatchery began an intensive coho salmon hatchery program in 1966 to mitigate for habitat lost due to the construction of Iron Gate Dam. Prior to this program, annual adult returns to Iron Gate Hatchery were 500 or fewer coho salmon (1963 to 1968). After the stocking program, hatchery returns ranged from 500 to1500 fish with the exception of 1987, when returns numbered over 2000 (Hiser 1991). Initial source stock for this intensive program was from the Cascade River, Oregon. In 1967 and again in 1969, the hatchery used Cascade River source stock. Numerous other stocks were also used at this hatchery (Table 20).

Source stocks for the Mad River Hatchery have been the most diverse of any of the hatcheries reviewed here (Table 20). Initial plantings in 1970 were of Noyo River-origin stock. Out-of-basin and out-of-state sources were used in many production years (e.g. 1972, 1973, 1978, 1979, 1981,1982, 1986, 1987, 1989).

Since its inception in 1980, coho salmon production at Warm Springs Hatchery has used Cascade River, Noyo River, and Prairie Creek stocks. Hatchery records show that Klamath coho salmon eggs were used in 1980 to produced 79,300 fingerlings that were released into Dry Creek (Brett Wilson; pers. comm.). In 1981 the hatchery received coho salmon eggs from the Klamath and Noyo Rivers. This pattern continued until 1986 when Warm Springs Hatchery received 30 adult fish from Hollow Tree Creek. Fourteen females were spawned. Klamath, Noyo, Dry Creek, (returns from the aforementioned fingerling release and yearling plants) and Hollow Tree Creek eggs were received through 1990. After 1990, Noyo River and Dry Creek eggs made up the total production at Warm Springs Hatchery. Prairie Creek Hatchery also historically used exotic stocks from Washington and Oregon, as well as Noyo River stocks.

Conclusions

The pattern that emerges from the available data suggests that California coho salmon hatcheries historically used eggs from out-of-basin and out-of-state broodstock. The majority of stock transfers were likely from sources within California (Table 20), and most coho salmon released from Department hatcheries historically were and currently are within-basin. However, some of the California origin hatchery stocks were originally derived from out-of-basin sources (Brown et al. 1994). Large transfers of distant origin (i.e. out-of-basin or out-of-state) stocks were common aspects of historical coho salmon hatchery operations. Stock transfers between ESUs, which have some level of currently observable reproductive isolation, appear to involve movement in both directions. Out-of-state stocks involved appear to be from Oregon and Washington. Such transfers were relatively common until the 1980s, but occur currently only on an exception basis (CDFG/NMFS 2001; NMFS 2001a). Now, out of basin transfers are only allowed in very restricted circumstances, and for all intents and purposes, have stopped. Data for planting of out-of-basin stocks are incomplete, but suggest that many streams in addition to those with production facilities were planted with excess hatchery production (Brown and Moyle 1991).

Several coho salmon hatcheries have had difficulty obtaining native broodstock over the past several years. While Department limits on production have been a large factor limiting coho salmon production at some facilities, the largest natural factor limiting production has been inability to collect broodstock.

Table 20. A partial list of the coho salmon stocks used at selected artificial production facilities in California. (Modified from Weitkamp et al. 1995, figure 36). Coho ESU abbreviations are CCC: Central California Coast, SONCC: Southern Oregon/Northern California Coasts, OC: Oregon Coast, LCRSWC: Lower Columbia River/Southwest Washington Coast, PSSG: Puget Sound/Strait of Georgia, NA: ESU designation is not applicable.

Facility (ESU)	Stocks used	State of origin of stocks used	ESU of origin of stocks used
Warm Springs Hatchery (CCC)	Warm Springs Hatchery	California	CCC
	Noyo River	California	CCC
	Mad River	California	SONCC
	Prairie Creek	California	SONCC
	Iron Gate	California	SONCC
	Cascade	Oregon	LCRSWC
	Other	California	NA
Noyo Egg Taking Station (CCC)	Warm Springs Hatchery	California	CCC
	Noyo River	California	CCC
	Mad River	California	SONCC
	Other	California	NA
Mad River Hatchery (SONCC)	Warm Springs Hatchery	California	CCC
	Noyo River	California	CCC
	Humboldt State University	California	SONCC
	Mad River	California	SONCC
	Prairie Creek	California	SONCC
	Trinity River	California	SONCC
	Iron Gate Hatchery	California	SONCC
	Alsea/Fall Creek	Oregon	OC
	Trask	Oregon	OC
	Klaskanine	Oregon	LCRSWC
	Sandy	Oregon	LCRSWC
	Skagit	Washington	PSSG
	Green River	Washington	PSSG
	Minter Creek	Washington	PSSG
	Other	California	NA
Trinity River Hatchery (SONCC)	Noyo River	California	CCC
	Eel River	California	SONCC
	Trinity River	California	SONCC
	Alsea/Fall Creek	Oregon	OC
	Cascade	Oregon	LCRSWC
	Other	California	NA
Iron Gate Hatchery (SONCC)	Trinity River	California	SONCC
	Iron Gate	California	SONCC
	Cascade	Oregon	LCRSWC

Hatchery and Genetic Management Plans

Hatchery and Genetic Management Plans (HGMP) are conservation mechanisms designed to allow employment of hatcheries in traditional and conservation roles while minimizing or eliminating certain risks associated with them. HGMP guidelines must:

- Contain clear goals, performance objectives, and performance indicators that state and apply the purpose of the program, its intended results, and its evaluation;
- Make use of the concepts of viable and critical salmonid population threshold as described in NMFS (2000). Listed populations may be taken for broodstock only according to certain criteria;

- Ensure that broodstock collection reflects appropriate priorities, taking into account fish health, abundance, and trends in the donor population. The primary purpose of broodstock collection of listed species is reestablishment of indigenous populations and for conservation purposes consistent with ESU recovery;
- Include protocols for fish health, broodstock collection, spawning, rearing, and release of juveniles, deposition of hatchery adults, and catastrophic risk management;
- Evaluate, minimize, and account for the program's genetic and ecological effects on natural populations;
- Describe interrelationships and interdependencies with fisheries management, providing as many benefits and as few biological risks as possible for listed species;
- Provide for adequate facilities to rear natural broodstock, maintain population health and diversity, and avoid hatchery-influenced selection or domestication;
- Provide for adequate monitoring and evaluation of success and risks that might impair recovery, and to allow revisions of program.

Warm Springs Hatchery is the only California state coho salmon production facility that has a HGMP drafted. This plan is currently under review by NMFS and the Department. Big Creek Hatchery is the only private hatchery currently permitted. At the time of this review it has submitted a HGMP and is awaiting ESA permitting from NMFS (Dave Streig, pers. comm.). In a recent hatchery review (CDFG/NMFS 2001), the Department and NMFS agreed that HGMPs will be developed for all California hatcheries. The conclusions and recommendations in the hatchery review will be used as interim guidelines for hatchery operations during the period when the Department develops the HGMPs and NMFS completes the ESA 4(d) Rule regulatory process relative to HGMP take limits.

State Policies on Wild Fish Management and Restoration

The Commission policy places management emphasis and priority on natural rather than hatchery-origin stocks. For example, FGC section 6901 states:

- Proper salmon and steelhead trout resource management requires maintaining adequate levels of natural, as compared to hatchery, spawning and rearing.
- Reliance upon hatchery production of salmon and steelhead trout in California is at or near the maximum percentage that it should occupy in the mix of natural and artificial hatchery production in the state. Hatchery production may be an appropriate means of protecting and increasing salmon and steelhead in specific situations; however, when both are feasible alternatives, preference shall be given to natural production.
- The protection of, and increase in, the naturally spawning salmon and steelhead trout of the state must be accomplished primarily through the improvement of stream habitat.

Also, Commission policy on Cooperatively Operated Rearing Programs for Salmon and Steelhead (CFGC 2002) states, "The bulk of the state's salmon and steelhead resources shall be produced naturally. The state's goals of maintaining and increasing natural production take precedence over the goals of cooperatively operated rearing programs." The Commission policy on salmon states that "Salmon shall be managed to protect, restore, and maintain the populations and genetic integrity of all identifiable stocks. Naturally spawned salmon shall provide the

foundation for the Department's management program." Clearly, the Department's management emphasis is on natural production.

Fish and Game Commission Policy on Salmonid Genetic Resources

It is the policy of the Commission (CFGC 2002) that the population and genetic integrity of all identifiable stocks of salmon and steelhead be maintained, with management emphasis placed on natural stocks. The Department focuses on protecting the genetic integrity of stocks through evaluation of salmon or steelhead streams and classification of their stocks according to probable genetic source and degree of integrity. By policy, natural stocks are preferred over hatchery stocks. Management and restoration efforts and the role of artificial production are guided by this classification system.

The goal of the Department's hatchery system to maintain genetic integrity of local stocks is accomplished through limitation of inter-basin transfer of eggs or fish and development of mating protocols appropriate to each facility. Guidance on, or limitations of, straying by hatchery produced salmonids is not specifically provided by state policies. It is a general objective of hatchery operations to minimize interactions between artificially and naturally produced fish. However, this goal is primarily intended toward interactions of juveniles (e.g. competition and predation) rather than to returning adults.

Forestry Activities

Timber harvest has been scrutinized in the latter portion of the twentieth century with regard to its effect on anadromous salmonids of the Pacific Northwest, including those inhabiting coastal watersheds in California (Burns 1972; Meehan 1991; Murphy 1995). Currently, many agencies are taking actions in an attempt to: (1) understand the direct and indirect effects of forestry activities on coho salmon; (2) more effectively implement current FPR; (3) reduce impacts to potential or occupied coho salmon habitat; (4) restore degraded coho salmon habitat; (5) estimate the status of coho salmon in harvested watersheds; and (6) increase coho salmon populations. Besides the Department, state agencies addressing timber harvest-coho salmon issues include the California Department of Forestry and Fire Protection (CDF), BOF, the California Regional Water Quality Control boards (RWQCB), and the California Geological Survey (CGS). The two federal agencies primarily involved in timber harvest and coho salmon issues are the NMFS and the USFS.

California Forest Practice Act, California Department of Forestry and Fire Protection, and California Board of Forestry and Fire Protection

The FPA and FPR (California Code of Regulations, Title 14, section 895 et seq.; FPR) regulate timber harvest on private and state timberlands in California. The BOF is responsible for implementing laws, adopting regulations and provisions, overseeing the licensing of registered, professional foresters (RPF), and directing the CDF's activities regarding timber harvest. The CDF is the state's lead agency under CEQA and Z'Berg-Nejedly FPA responsible for implementing FPR, working with RPFs, and coordinating state agency review. The CDF is the primary agency responsible for ensuring that timber harvest practices are properly planned and implemented and that harvest impacts are properly analyzed and addressed.

The first forest practice act in California was enacted in 1945, and forestry practices have been regulated since that time. In 1971, the 1945 act was found unconstitutional because of the manner for which it provided for the promulgation of the FPR (Berbach 2001). In 1973, the Z'Berg-Nejedly FPA (Division 4, Chapter 8 Public Resources Code, Section 4511 et seq.) was passed and signed and went into affect in 1975. BOF regulations, adopted to implement FPA 1973, lay out the provisions for the implementation of timber harvest through Timber Harvest Plans (THP), Sustained Yield Plans (SYP), Nonindustrial Timber Management Plans, and Program Timberland Environmental Impact Reports. Prior to 1973, there was not any specific protection of streams and riparian areas. FPA 1973, and regulations promulgated by the BOF, resulted in stream and lake protection zones, defined as 100 foot buffers along water bodies that supported salmon and trout and 50 foot buffers along all other water bodies. There were several other provisions to these regulations:

- Timber operation could remove up to 50% of stream or lake side canopy, and this allowance was for each harvest entry on a site, allowing for the possibility that less than 50% of the canopy might be present if more than one harvest occurred in a given site.
- Stream crossings created for harvest activities must be able to handle 25-year flood events.
- Soil quantities deleterious to fish could not be discharged into water bodies.
- Stream- and lake-beds could not be used for landings, roads, or skid trails except as allowed by the FGC.

In 1983, the BOF revised FPRs to increase protection for water and aquatic resources, resulting in groups of measures referred to as watercourse and lake protection (Title 14 CCR Article 6). The important change was the addition of protection of beneficial uses of water and riparian function (Title 14 CCR section 916.2, 936.2, 956.2). Changes in FPRs to benefit fish and wildlife uses included:

- Stream- and lake-side protection was based on watercourse type and slope, the greater the slope, the greater the buffer width;
- maximum buffers ranging from 50-200 feet;
- class I streams could have 50% of over-story canopy removed, but under-story canopy had to be retained;
- class II streams could have 50% of over- and under-story canopy harvested[19];
- discharge of deleterious pollutants was prohibited; and
- stream crossing created for harvest activities had to be able to handle 50-year flood events.

The BOF further refined stream and riparian protection, primarily for the biological needs of fish and wildlife species, in 1991. Important changes included:

- Measures to protect restorable uses of water for fisheries and measures to protect biological needs of fish and wildlife species provided by riparian habitat.
- For class I and II streams where there is less than 50% of canopy, only removal of trees for sanitation salvage is allowed.

[19] For both class I and II watercourses, subsequent harvest could remove up to 50% of existing canopy, resulting in the possibility that more than 50% of the initial canopy existing at the first entry would be removed.

- The first measures to retain and recruit LWD for class I and II streams and considerations for regarding streambed and flow relationships to LWD.
- Specific measures for water temperature control, upslope, bank, and stream channel stability; filtration of both organic and inorganic material before entry in watercourses, and maintaining upslope vegetative diversity for wildlife habitat and tree snag supply.
- The maximum buffer protection zone for class I streams was reduced from 200 feet to 150 feet.
- Canopy retention for class II streams was changed to overall retention of 50%.

In response to the listing of coho salmon under the ESA, the CDF issued considerations for addressing coho salmon in THPs (CDF 1997b). The intent was to provide background about coho salmon that would enable RPFs to prepare, and CDF inspectors to review, THPs with emphasis on avoiding significant impacts to the species. The document included coho salmon life history, potential impacts of timber harvest to different life history traits, and possible measures above and beyond the FPRs that could be applied to any pertinent harvest impacts. The information was advisory only and designed to identify and mitigate site-specific impacts to coho salmon. Its effectiveness was based on the quality and attention given to plan preparation, review, and monitoring. Also, in 1997 and again in 2000, the CDF revised its policy guidance and field application of identifying habitat for non-fish aquatic species and the FPR's class II stream designation and conservation. The purpose of improving stream classification skills was to assure that sensitive amphibian habitat was correctly identified and protected (CDF 1997a, 2000); these measures would also benefit downstream habitat for anadromous salmonids.

In 1998, the California Resources Agency and NMFS established a blue ribbon panel of scientists to evaluate the relationship of California FPRs and salmonid habitat in northern California and the Klamath Mountains Province Steelhead ESU. The SRP released its findings as its *Report of the Scientific Review Panel on California Forest Practice Rules and Salmonid Habitat* (Ligon et al. 1999). The report considered biological requirements of salmonids, proposed strategies for improving the timber harvest planning process for anadromous salmonids, and perhaps most importantly, evaluated timber harvest effects, and recommended improvements for specific FPRs. The rules specifically addressed included watercourse and lake protection zones, LWD recruitment, geological concerns, road construction and maintenance, watercourse crossing structures, harvest site preparation, winter harvest operations, and harvest limitations. Based upon the SRP's findings and recommendations, the BOF adopted interim FPRs that went into effect in the summer of 2000. The interim rules established the following provisions for better protecting salmonids and their habitat:

- Watercourse transition lines used to identify channel zones are measured using full bank width for confined channels rather than riparian vegetation.
- No harvest can occur in channel zones.
- Minimum buffer protection for class I streams is 150 feet.
- Minimum over-story canopy retention be increased from 50% to 65-85%.
- More LWD recruitment potential by retaining the largest trees available, and measured in 330' segments and not per acre.
- Increased buffer protection for streams in inner gorges and increased sediment control.

These interim rules are referred to as the Threatened and Impaired Watershed Rules (FPR Sections 916.9, 936.9, 956) and were extended at the end of 2000 with minor modifications, again in 2001, and are set to expire on December 31, 2002. Another primary finding of the SRP was that a significant deficiency of FPRs is the absence of watershed analysis, specifically analysis that lends itself to assessing cumulative effects that could be attributed to forestry practices or any other activities in a watershed. The BOF responded to this critique in November 2001 by adopting additional interim rules in an attempt to identify and mitigate forestry practices that affect anadromous salmonids. The BOF adopted the Interim Watershed Mitigation Addendum (IWMA) as an approach for timber landowners and state agencies, including the CDF, the Department, the CGS, and the RWQCBs, to work together on specific timber harvest plans[20]. The IWMA was proposed to expire on December 31, 2002.

Under the IWMA, the landowner could consult with state agencies to identify limiting factors to anadromous salmonids within a specific watershed, identifying specific mitigation measures to address the limiting factors, and conduct initial effectiveness monitoring of these measures. The IWMA would be attached to a THP proposal and subject to the THP review process when the THP is submitted to the CDF. However, in December 2001, the Office of Administrative Law rejected the IWMA rule package because the rules lacked clarity.

Though current permanent and interim rules affect all native fishes and other amphibious and aquatic wildlife, the emphasis and focus is clearly on understanding and improving forest practices that affect coho salmon.

Pacific Lumber Company Habitat Conservation Plan

Since its inception in March 1999, the Department has actively participated along with other agencies in assisting the PALCO implement its 50-year Habitat Conservation Plan (HCP). The PALCO HCP covers approximately 210,000 acres of PALCO's lands in Humboldt County. Among 17 terrestrial and aquatic species, PALCO's incidental take permits cover steelhead rainbow trout, cutthroat trout, chinook salmon, and coho salmon.

The goal of the Aquatic Conservation Plan (ACP) of the PALCO HCP is to maintain or achieve, over time, a properly functioning aquatic habitat condition. This condition, as defined by NMFS, is essential for the long-term survival of anadromous salmonids and is described in a matrix with habitat variables necessary to achieve this goal.

The main thrusts of the ACP include control of sediment from roads, landslides, and other sources; restrictions on timber operations in riparian management zones along watercourses; a governor on forest management activities within hydrologic units; and aquatic monitoring. PALCO must complete watershed analyses of all covered lands within five years of the beginning of the HCP period, through which, the interim prescriptions of the ACP are to be modified to address watershed-specific habitat conditions. The types of monitoring under the ACP aquatic monitoring program include trend, hillslope, instream effectiveness and compliance monitoring.

[20] Staff from these agencies already work together in teams, under the leadership of the CDF's harvest inspectors, to review THPs.

PALCO is required to fund an HCP Monitor under contract to the Department. The Department coordinates a six-member HCP Monitor team that monitors PALCO's compliance with HCP conservation measures. Particularly during the winter period, the HCP Monitor focuses on compliance with restrictions on wet weather road use, road construction, and road storm-proofing. The HCP Monitor prepares compliance monitoring reports, which are provided to PALCO and federal and state agencies, and maintains information on databases and in a geographic information system (GIS). The Monitor's post-harvest monitoring, in particular, has given insights to the effectiveness of both HCP conservation measures and the FPR. PALCO has a programmatic streambed alteration agreement with the Department that provides it with a streamlined approach for watercourse crossing construction.

The Department's efforts to help implement the PALCO HCP stems from commitments that the signatory agencies (USFWS, NMFS, CDF and the Department) made to help the PALCO HCP succeed while meeting the company's operational needs. The Department and the other agencies also have a responsibility to their other stakeholders to help ensure PALCO complies with the provisions of the HCP. As the first forest land HCP in California, the agencies have an interest in its success and presenting it as an example of how HCPs can be a viable option for other large landowners.

The strengths of the aquatic component of the PALCO HCP lie in its reliance on robust stream buffers, its measures pertaining to forest roads, and opportunities to modify its conservation measures through watershed analysis. The PALCO HCP provides "no cut" vegetated buffers on all classes of watercourses, including along Class III watercourses, which is both unprecedented and controversial from the perspective of the timber industry. Wet weather road uses, including hauling, maintenance when the soil is saturated, and construction, have been implicated as important sediment discharge and impact mechanisms to coho salmon and its habitat; hence many of the ACPs includes conservation measures that pertain to road inventory, maintenance, storm-proofing and wet weather road restrictions. The PALCO HCP watershed analysis process holds promise that the ACP conservation measures can be modified to address salient conditions in watersheds that affect the quality and extent of salmonid habitat.

The Department staff assigned to help implement and monitor the PALCO HCP activities includes a senior environmental scientist (supervisor), four environmental scientists, and an office technician. One environmental scientist is dedicated full-time to implement and review watershed analysis and the aquatic monitoring program. The other environmental scientists complete a large number of consultations, mostly in conjunction with THP review, which the PALCO HCP mandates: botanical, marbled murrelet (*Brachyramphus marmoratum*) disturbance minimization; and risk assessment of road construction across unstable areas. They also process many BOF sensitive species consultations (e.g. osprey, golden eagle [*Aquila chrysaetos*], northern goshawk [*Accipiter gentilis*]). The Department staff screen, review, and inspect PALCO HCP timber harvesting plans; PALCO has submitted on average some 100 plans each year. They also review and comment on PALCO's annual reports for four HCP operating conservation plans: aquatic, sensitive plant, northern spotted owl (*Strix occidentalis caurina*), and marbled murrelet. Other activities include assisting PALCO with implementing its marbled murrelet monitoring and research programs and review of PALCO's proposals for adaptive management and HCP amendments.

Fish and Game Regulations and Protection of Stream and Riparian Areas

Though the Department is not the lead agency for timber harvest oversight, under CEQA it is a trustee agency or a responsible agency when it will issue a permit or enter into an agreement. The Department has several responsibilities regarding timber harvest including protection of state-listed plants and animals, protection of fish and wildlife resources, consultation with the CDF and RPFs on BOF-listed sensitive species, identification of needs of fisheries, and regulation of activities in and along the lakes, streams, and rivers. The State codes and related Department activities are the means and manner of the DFG's involvement in timber harvest and protection of coho salmon and other anadromous salmonids.

The first such protection occurred in 1951, when the State Legislature passed and the Governor signed into law FGC Section 5948 which prohibited log jams or debris dams in the North Coast District of the CDF that would prevent fish passing up and down streams, or were determined to be deleterious to fish by the Commission. In 1957, FGC Section 5948 was applied to the entire state. In 1961, FGC Section 1600-1602 was enacted, requiring notification for diversion, obstruction, or changes to water bodies, including lakes and streams. This section of the FGC is cited in the FPRs. However, this did not result in reducing the concern over effective stream protection from the effects of logging practices of the period, and the Department, BOF, Legislature, and others continued to look for meaningful protection for another decade (Arvola 1976).

Currently, the Department is undertaking several activities in an attempt to better understand the effects of timber harvest activities on coho salmon and their habitat and to ensure that THPs are being implemented properly. First, within six north coast counties (Sonoma, Mendocino, Humboldt, Del Norte, Trinity, and Siskiyou), the Department is budgeted to conduct desk review of every THP and full review for 25% of those THPs. Full review includes participation in field inspections and interagency review teams. Second, the Department is monitoring THP implementation to ascertain the effectiveness of the Department recommendations within the range of northern coho salmon. Third, the Department is working with the CDF and timber companies along the north coast in an attempt to learn the practices that may best protect or benefit coho salmon habitat.

Other California State Agencies

Two other state agencies, the RWQCBs and the CGS, participate in the review of THPs, SYPs, and Nonindustrial Timber Management Plans. They are official members of the review teams along with the Department and the CDF. Each agency attempts to address some potentially significant timber harvest effects. The RWQCBs primarily are interested in protecting the beneficial uses of water, which includes cold-water fishes such as coho salmon, from impacts caused by modified water quality, water flow, water pollution sources, and sediment loads. The CGS primarily focuses on preventing mass wasting events, many of which impact salmonid habitat. They often recommend measures to minimize sediment loads by reducing erosion, landslides, and mass wasting events.

Federal Agencies

NMFS is responsible for protection of coho salmon on federal lands, and the USFS and the Bureau of Land Management (BLM) are responsible for timber sales on federal lands. NMFS also is responsible for federal protection of coho salmon on state and private lands and is currently working with state agencies to address forest practice effects. Consequently, these federal agencies work together to integrate the protection of coho salmon with forestry activities on federal lands in northern California.

In 1993, the federal government released the *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment (Report),* of the Forest Ecosystem Management Assessment Team (FEMAT). Six agencies, including the USFS, BLM, National Park Service, National Oceanographic and Atmospheric Administration, USFWS, and USEPA participated. The primary reason for this effort was to develop a management plan to protect the northern spotted owl across its entire range, but the FEMAT Report addressed the comprehensive management needs for federal lands within the owl's range. The assessment was an effort to develop a forest management plan for the Pacific Northwest that would address the multitude of biological, economic, and social issues plaguing forest management in this region. FEMAT focused on maintenance and restoration of biodiversity, particularly of late-successional and old-growth ecosystems (FEMAT 1993). FEMAT was developed by several panels composed of experts from across the northwest. Two panels, the aquatic and watersheds groups, are pertinent to coho salmon conservation. They recommended that watershed analysis, watershed restoration, and the establishment of riparian reserves be integrated in silviculture and other management activities on federal forested lands.

In February 1994, the USFS and the BLM released the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forests Related to Species Within the Range of the Northern Spotted Owl (SEIS). Amongst its many components, the SEIS presented the FEMAT Report recommendations, with slight modifications, and included 10 action alternatives. The Aquatic Conservation Strategy incorporated in alternative1, 4, and 9 provided the greatest levels and opportunities for salmonid habitat and species stabilization, reversal of habitat degradation, riparian and aquatic ecosystem recovery, and reduction of silvicultural disturbance to late-successional and riparian reserves (SEIS 1994). The federal agencies adopted Alternative 9, which includes the following conservation and riparian reserve elements:

- 2,627,500 proposed acres for riparian reserves (out of a total of 24 million acres);
- buffer protection area[21] for fish-bearing streams of 300 feet or two times the height of a site-potential tree[22];
- buffer protection area for non-fish bearing streams of 150 feet or the height of a site-potential tree;
- buffer protection area for intermittent streams of 100 feet or the height of a site-potential tree;
- protection for 100-year flood plains, inner gorges, and unstable slopes;
- identification of key watersheds to provide refugia for at-risk anadromous salmonids;
- watershed analysis; and

[21] Buffer distance is on both sides of the watercourse and is the greater of the two values.

[22] Site-potential tree is defined as a tree that has attained the average maximum height possible given site conditions where it occurs.

- a comprehensive watershed restoration program.

In April 1994, the Record of Decision on the Final Environmental Impact Statement was published and implementation of the management plan commenced. Currently, the standards for the riparian reserves are applied on USFS and BLM lands, and a monitoring program is tracking the results of the implementation of management plan standards.

In 1995, the National Oceanographic and Atmospheric Administration released an analysis addressing forestry practices and protection and restoration requirements in Alaska and the northwest Pacific states (Murphy 1995). California coho salmon ESUs were listed under the ESA in 1996 and 1997. NMFS designated critical habitat for both ESUs in 1999. Also in 1999, the NMFS was sued over four "no jeopardy" biological opinions, one programmatic and three site-specific, submitted for 23 timber harvest sales on federal lands in Oregon. The plaintiffs asserted that the NMFS did not properly evaluate site-specific, watershed, or cumulative effects in its consideration of impacts to the federally-listed coho salmon and the implementation of the ACS. Both the federal district and appellate courts agreed with the plaintiffs and found that the NMFS had acted arbitrary in its finding of "no jeopardy"[23] biological opinions for 20 of the 23 timber sales. Both courts stated that the NMFS had failed to 1) evaluate short-term habitat degradation; 2) sufficiently incorporate watershed analysis; and 3) assess cumulative effects (USCA 2001). The court rulings affected these biological opinions but also enjoined 170 federal timber sales in Washington, Oregon, and northern California.

Since the ruling, the NMFS has ceased its consultations on timber sales in northern California other than those submitted under the National Fire Plan[24]. At this time, the Department does not know the immediate or longer-term ramifications of these court rulings on forestry practices and protection of coho salmon on federal lands in northern California.

In 2000, the NMFS released guidelines for forestry practices in California (NMFS 2000). These guidelines were intended to aid the State and the BOF in revising FPRs such that forestry practices would maintain ecosystem functioning in upslope, riparian, and instream habitats on non-federal lands where federally-listed anadromous salmonids occur. Their recommendations included seven major points: 1) proper stream classification; 2) developing strategies to address adverse impacts to riparian areas; 3) improving road construction and maintenance and addressing impacts from roads; 4) developing strategies for unstable and steep slopes; 5) implementing only sound restoration activities; 6) conduct watershed analysis and cumulative effects assessment; and 7) implement monitoring and adaptive management programs. Currently, the NMFS is working with the BOF and state agencies in an effort to find the best means to protect coho salmon where timber harvest occurs on state and private lands.

Water Diversion and Fish Passage Remediation

Fish Screens

The Department and the NMFS have established fish screen design criteria to protect juvenile salmonids in proximity to water diversions from injury, migration delay, or mortality. The swimming ability of fish is the primary consideration in establishing the criteria. The screen

[23] Jeopardy is defined as actions the would jeopardize the continued existence of a listed species or adversely modify or destroy critical habitat; federal Endangered Species Act, Section 7(a) (2).

[24] Consultations on these sales are continuing because the timber sales are associated with reducing hazardous fuel loads.

hydraulics are designed to allow fish to voluntarily be guided and/or to escape the screen. Voluntary guidance means a fish is under control and able to be guided or move away from the screen. This minimizes the threat of impingement on, or entrainment through, the screen. Swimming ability, however, varies depending on multiple factors relating to fish physiology, biology, and the aquatic environment. These factors include species, physiological development, duration of swimming time required, behavioral aspects, physical condition of the fish, water quality, and lighting conditions. The fish screen criteria provide non-regulatory, non-binding construction and operation guidance for screens on all new and existing diversions [25].

The Department's Fish Screen and Fish Passage Program has initiated an inventory of water diversions and fish passage problems on coastal streams and rivers. The first of these inventories was conducted on the Russian River between July 2000 and May 2001 and covered the river from Lake Mendocino near Ukiah downstream to the mouth. A total of 196 diversions, dams, and weirs was identified. Approximately 64% of the diversions were between 1 and 10 inches (outside diameter) and approximately 20% were between 11 and 20 inches (outside diameter). The remaining 16% consisted of unknown size and were greater than 20 inches. Recently, there has been a major cooperative effort between the diverters and Natural Resources Conservation Services to screen many of these diversions. Approximately 36% of the diversions were screened in accordance with the Department's salmon or steelhead screening criteria. The remaining 64% are unscreened or unknown.

Sponsored by several government agencies, fish screen installations began in the 1920s in Trinity and Siskiyou counties. There are numerous early accounts of thousands of juvenile salmon and steelhead lost in irrigation diversions in this region. Early fish screen designs were crude and caused many problems for water managers. In 1945, the Department began a fish screening program that would eventually lead to the screening of many water diversions in high-priority coho salmon streams in these counties. Because most of the existing screens and greatest fish losses were in the Klamath River drainage, it was decided to establish a fish screen headquarters in Yreka, Siskiyou County in 1946. This shop now maintains 68 fish screens in Siskiyou County. Department screen shops build and repair screens but are limited by budget constraints.

In 1956, a fish screen headquarters was established in Red Bluff that maintains fish screens in the Central Valley and operates 22 screens in Trinity County. In 1992, a shop was constructed in Lewiston to maintain the Trinity County screens. The majority of the screens operated by these three installations in Siskiyou and Trinity Counties are on streams presently or historically containing coho salmon. However, many water diversions remain unscreened in these counties. As an example, the Siskiyou Resource Conservation District (RCD) has received grant funding from the Wildlife Conservation Board to screen the remaining 31 diversions in the Scott River drainage that are within the range of coho salmon.

Most Department fish screens in coho salmon habitat, except two in Trinity County and two in Siskiyou County, are located on gravity flow surface diversions. The most common fish screen type on gravity diversions is the vertical or inclined diagonal flat-plate design. The screen guides juvenile coho salmon to a bypass structure connected to a pipe or open ditch to carry the fish back to the stream. If the stream flow below the diversion is not capable of providing

[25] The Fish Screen Criteria have regulatory effect in the 2084 order applicable during the coho candidacy period, (Cal. Code regs. tit. 14 section 749.1).

habitat, a trap is installed in the bypass structure and the fish are recovered and moved to an area of the watershed capable of providing suitable habitat. Water diversions are generally opened about the first of April and remain operating until the end of October. On some diversions, water for livestock is diverted throughout the winter period.

In Humboldt County, the Humboldt Bay Municipal Water District pump station at Essex on the Mad River is screened but may need to be modified to adequately protect coho salmon juveniles. Mad River Hatchery still pumps some water from the Mad River although most of the hatchery water supply is from wells. The hatchery screens may also need to be upgraded. The Hoopa Tribe operates several smaller screens on tributaries to the Trinity River near Hoopa. There are numerous smaller unscreened diversions throughout the area, particularly in the Eel and Mattole drainages. These diversions are mainly small pumps for domestic water use or small agricultural operations and they have the potential to take coho salmon.

Instream Flows

The importance of adequate instream flows for the protection of anadromous fish has long been recognized. FGC Section 5937 requires that diverters "....allow sufficient water to pass over, around or through [a] dam, to keep in good condition any fish that may be planted or exist below the dam." However, the Department does not regulate or permit water rights, hence many of the state's waters have inadequate minimum flows. In larger regulated river systems such as the Trinity, long-term flow studies have been conducted to identify in-river flows needed by the various life stages of anadromous fish.

Trinity River: A twelve-year flow study culminated in a recommendation, supported by the Department, that instream flows be increased to approximately 47% of the inflow above Trinity Dam and be based on five water-year types ranging from *critically dry* to *extremely wet*. This recommendation was adopted by the Secretary of the Interior in a Record of Decision, in January 2001. Subsequent to the signing of the ROD, several water and power users challenged the decision. A ruling was issued that prevented the implementation of the new flow regime until such time as a supplemental EIS/EIR could be completed that more fully considered issues such as economic impacts from lost water and power generation, and the effect on Central Valley threatened and endangered species from reduced diversions into the Sacramento River.

Klamath River: In the Klamath River below Iron Gate Dam, a flow study is currently underway to determine anadromous fish flow needs. Current minimum instream flow releases at Iron Gate Dam were established by the FERC as part of the 1956 Klamath Hydroelectric Project license (FERC No. 2082). These minimum flow releases have frequently not been met during the period 1961 to 2000 because the USBR's Klamath Project controls most of the flow in the Klamath River. In the past, the Klamath Project has provided water to irrigation in lieu of downstream deliveries during below average water years. Since 1995, the Klamath Project has been operated based on an annual operations plan that considers threatened and endangered fish species needs in the watershed.

In a recent response letter to the USBR's "*Draft Biological Assessment of the Effects of Proposed Actions Related to Klamath Project Operations April 1, 2002 - March 31, 2012, on Federally Listed Threatened and Endangered Species*", the CDFG provided a comparison of flow recommendations contained in Hardy and Addley (2001) and current FERC flow minimums contained in the federal power license for operating Iron Gate Dam (Table 21). The Department

supports the Hardy Phase II flows to develop a flow regime in the Klamath River over five water-year types that would adequately consider California's anadromous fishery resources and allow for recovery of California coho salmon populations.

Table 21. Recommended draft Hardy Phase II (HP II) flows for five water-year types vs. Federal Energy Regulatory Commission (FERC) minimum flows in the Klamath River at Iron Gate Dam (all flows in cfs).

	Water Year Type [v]					
	Critically Dry	**Dry**	**Average**	**Wet**	**Extremely Wet**	**All**
Time Period	HP II [w]	HP II	HP II	HP II	HP II	FERC [x]
Oct.	1100	1200	1470	1660	1900	1300
Nov.	1200	1400	1710	1970	2200	1300
Dec.	1300	1600	2030	2400	3500	1300
Jan.	1500	2000	2400	2970	4200	1300
Feb.	1600	2200	2720	3500	5000	1300
Mar. 1-15	1600	2400	3400	4300	5400	1300
Mar. 16 -31	1600	2400	3400	4300	5400	1300
Apr. 1-15	1600	2200	3300	4100	5200	1300
Apr. 16-30	1600	2200	3300	4100	5200	1300
May 1-15	1600	2100	3100	3700	4500	1000
May 16-31	1600	2100	3100	3700	4500	1000
June 1-15	1350	1800	2300	2900	3800	710
June 16-30	1350	1800	2300	2900	3800	710
July 1-15	1000	1250	1530	1970	2300	710
July 16-31	1000	1250	1530	1970	2300	710
Aug.	1000	1000	1250	1470	1800	1000
Sept.	1000	1100	1350	1570	1840	1300

[v] Water Year Types are defined by the following exceedance values for inflow at Iron Gate Dam: Extremely Wet - 10% exceedance; Wet - 30% exceedance; Average - 50% exceedance; Dry - 70% exceedance; Critically Dry - 90% exceedance

[w] HP II are the recommended minimum instream monthly flows at Iron Gate Dam contained in the November 21, 2001 Draft Phase II Final Report: *Evaluation of Interim Instream Flow Needs in the Klamath River* prepared by Hardy and Addley (2001).

[x] FERC are the current FERC minimums that apply to all water year types.

The Department anticipates that the draft Hardy Phase II flow recommendations will be modified as appropriate based on further analysis and new data developed during preparation of the final report due in April 2002. The Department is uncertain how the Final Hardy Phase II Report will reflect the conclusions and recommendations within the Final Interim Report being prepared by the Natural Resource Council's Committee on Endangered and Threatened Fishes in the Klamath River Basin. Their report is entitled "*Scientific Evaluation of Biological Opinions on Endangered and Threatened Fishes in the Klamath River Basin*" and is scheduled for completion in April 2002.

In Siskiyou County, a fish rescue program has been in place since the Department's screen shop in Yreka was established. As stream flows diminish in late spring, coho, chinook and steelhead juveniles become trapped in isolated pools and subsequently perish. The reduction in stream flow coincides with increased extraction of water in irrigation diversions through most coho salmon streams in this area. Fish are trapped or seined from the desiccating pools, transported in aerated tanks, and released in an area of the stream that is capable of sustaining the fish through the summer months. Fish rescue records show a steady decline in fish numbers. In 1972, personnel at the Yreka shop rescued 743,669 juvenile salmonids. In 2001, 57,627 fish were rescued, of which 69 were coho salmon juveniles.

Eel River: State and federal agencies, Pacific Gas and Electric Company, local Native American tribes, and interested parties are developing a water management strategy aimed at mimicking natural flow patterns of the upper Eel River. There has been substantial voluntary interim increases in water releases from Scott and Cape Horn dams during the fall and spring seasons. The fall releases are needed for adult chinook salmon to gain access to the upper Eel River watershed during spawning migrations. Spring release flows are intended to mimic natural flow patterns that salmon and steelhead trout smolts use as a cue to initiate downstream migration. Summer minimum bypass flows are currently set at five cfs (CDFG 2001b).

Russian River: Minimum flows in the Russian River and Dry Creek were established by the State Water Resources Control Board in Decision 1610 issued in April 1986. Summer minimum flow in the Russian River between the East Branch and Dry Creek is 150 cfs. Downstream of the Dry Creek confluence the summer minimum flow is 125 cfs. Summer minimum flow in Dry Creek is 75 cfs. During dry years and critically dry years the minimum flows are less; during a critically dry year the minimum flow in the Russian River between the East Branch and Dry Creek is 25 cfs. The classification of the water-year is based on the cumulative inflow to Lake Pillsbury on the Eel River that is determined on the first of each month between January and June.

There are no recommendations pending at this time to change the flow release pattern from either Coyote Dam or Warm Springs Dam. There is currently in progress a formal consultation, pursuant to Section 7 of the ESA, between the NMFS, the USACE, and the Sonoma County Water Agency. Flow release patterns for both flood control operations and summer minimum flows are a part of this consultation. Options that will be considered include: changes in the ramping rates for flood control releases; developing a "natural flow" schedule that would, as nearly as possible, mimic the flow patterns that would have occurred naturally in the Russian River; and piping water directly from Warm Springs Dam to either the Russian River or to the Mirabel pumping facility to reduce flows in Dry Creek to a more natural level. Once the Section

7 consultation has been completed, the NMFS or the Department may recommend some changes in the flood control release or minimum flow schedule for the Russian River.

Walker Creek: According to a 1985 agreement between the Department and the Marin Municipal Water District, winter releases of 10 to 20 cfs, and summer releases of 2 to 5 cfs are made, depending on reservoir storage. In exceptionally dry years, a minimum release of 0.5 cfs is made. There are no recommendations at this time to change the flow release pattern from Soulajule Reservoir. Future studies might find, however, that the higher than natural flows could result in water temperatures above the optimum for coho salmon. Lower flows might result in less habitat for steelhead trout and other species, but also lower temperatures in the pools used by coho salmon.

Lagunitas Creek: Prior to 1979, there were no instream flow release requirements for the dams on Lagunitas Creek. A small quantity of water, however was released to meet the needs of downstream users. In 1979 an agreement was reached between the Marin Municipal Water District and the Department to release from Kent Lake, 10 cfs in winter and 3 cfs in summer in normal years, to maintain salmon and steelhead in Lagunitas Creek. In 1983, the SWRCB adopted Decision 1582 which set these minimum flow releases as an interim requirement and required further investigation of instream flow needs and measures to reduce sediment in the stream. After ten years of study, the SWRCB conducted a new set of hearings and adopted Order WR 95-17 in 1995. This order established the current set of minimum flow releases and other conditions to improve fish habitat in Lagunitas Creek. Current summer minimum flow is 8 cfs in a normal year and 6 cfs in a dry year; current winter minimum flows range from 20 to 25 cfs. There are also attraction flow pulses required in the fall to encourage upstream migration of coho salmon.

Fish Passage

Reestablishing access to former habitat above artificial barriers is a fundamental approach to anadromous fish restoration and has met with considerable success. The Department is involved in several efforts to provide fish passage for coho salmon and other salmonids in the north and central coast. Removal or retrofitting existing barriers to allow for fish passage can be an extremely cost-effective method of recovery planning. The key physical characteristics of the stream which inherently affect salmonid migration should be understood before any attempt is made to remove or modify an obstruction.

Fish Passage Forum: In November 1999, the California Resources Agency convened a group of state, local, and federal agencies, fisheries conservation groups, researchers, restoration contractors, and others to discuss ways to restore and recover anadromous salmonid populations by improving fish passage at artificial barriers. This forum is part of the Resources Agency's effort to implement an eight-point California Coastal Salmon and Watersheds Program, which includes an objective to coordinate fish passage activities.

A Fish Passage Work Group identified the need for improved efforts to identify barriers, evaluate and prioritize restoration opportunities, and implement projects in a timely fashion. It identified administrative, financial, and technical impediments to addressing these issues, including information gaps, lack of watershed-level assessment and planning, and poorly coordinated project review and permitting processes. Short-term solutions were developed for

these types of problems for several known high-priority fish passage projects. Subgroups were established for coordinating activities related to fish passage inventory and assessment protocols, data format and access protocols, information and literature collection, training, and public education and outreach.

The Fish Passage Forum established that there is a critical need for improving coordination of existing agency programs and private sector activities across jurisdictions to improve the timeliness and cost-effectiveness of fish passage restoration efforts. An interagency memorandum of understanding (MOU) is being developed that will identify agency roles and responsibilities. The Department anticipates that this MOU will support voluntary, cooperative efforts to pursue some or all of the following goals:

- Protect, restore and maintain watershed, stream, and estuary conditions for passage by anadromous fish.
- Identify passage barriers, opportunities to remedy them, and priorities for implementing restoration projects.
- Improve the State's ability to implement fish passage restoration projects by coordinating agency and private sector efforts.
- Secure adequate funding for fish passage restoration.
- Expedite implementation of on-the-ground projects by coordinating and, where possible, streamlining agency permitting processes while ensuring that restoration programs comply with CESA and ESA requirements for protecting listed species.
- Educate and increase public awareness of fish passage issues to develop support for solving problems and preventing new ones.
- Attempt to ensure that any new structures created are properly designed to allow fish passage.

Gravel Extraction

Properly planned and conducted gravel extraction can avoid, minimize, or mitigate adverse impacts to fisheries resources. It is possible that fisheries resources can realize beneficial effects by combining adaptive planning and extraction methodologies with flexible and site-specific mitigation measures. The river beds are constantly changing and adjusting whether or not gravel extraction is occurring. Therefore, it is imperative that any extraction planning and mitigation effort remain flexible. Measures taken to avoid or minimize stranding of fish include adherence to specified post-extraction slopes. Determination of these slopes is an end product of the review process and incorporates pre-extraction reports and approval by the USACE.

NMFS has developed a national policy on gravel extraction. The objective of the NMFS Gravel Policy is to ensure that gravel extraction operations are conducted in a manner that eliminates or minimizes to the greatest extent possible any adverse impacts to anadromous fish and their habitats. Gravel extraction operations should not interfere with anadromous fish migration, spawning, or rearing, nor should they be allowed within, upstream, or downstream of anadromous fish spawning grounds. The intent is to conserve and protect existing viable anadromous fish habitat and historical habitat that is restorable. Individual gravel extraction operations must be judged in the context of their spatial and temporal cumulative impacts; i.e. potential impacts to habitat should be viewed from a watershed management perspective.

Gravel operators are generally required to comply with FGC section 1600 et seq. before commencing their operations. The USACE may require a permit for dredge and fill operations and other activities associated with gravel extraction projects under Sections 401 and 404 of the CWA, and/or Section 10 of the Rivers and Harbors Act of 1899. Under the Fish and Wildlife Coordination Act, NMFS reviews Section 10 or Section 404 permit applications for environmental impacts to anadromous, estuarine, and marine fisheries and their habitats. Gravel extraction projects not subject to Section 404 or Section 10 permits may still be reviewed by NMFS pursuant to the applicable County/State public hearing processes. The Magnuson Fishery Conservation and Management Act also addresses the effects which changes to habitat may have upon a fishery**.**

NMFS has made recommendations in a national policy on gravel extraction that provide specific guidelines described below:

Abandoned stream channels on terraces and inactive floodplain should be used preferentially to active channels, their deltas and floodplain. Gravel extraction sites should be situated outside the active floodplain and the gravel should not be excavated from below the water table. In other words, dry-pit mining on terraces or floodplain is preferable to any of the alternatives, in particular, wet-pit mining instream, but also bar skimming and wet-pit mining in the floodplain. In addition, operators should not divert streams to create an inactive channel for gravel extraction purposes, and formation of isolated ponded areas that cause fish entrapment should be avoided. Also, all gravel extraction activities for a single project should be located on the same side of the floodplain. This will eliminate the need for crossing active channels with heavy equipment.

Larger rivers and streams should be used preferentially to small rivers and streams. Larger systems are preferable because they have more gravel and a wider floodplain, and the proportionally smaller disturbance in large systems will reduce the overall impact of gravel extraction (Follman 1980). On a smaller river or stream, the location of the extraction site is more critical because of the limited availability of exposed gravel deposits and the relatively narrower floodplain (Follman 1980).

Braided river channel-types should be used preferentially to other river channel-types. The other channel-types, listed in the order of increasing sensitivity to physical changes caused by gravel extraction activities, are: split, meandering, sinuous, and straight (Rundquist 1980). Because braided river systems are dynamic and channel shifting is a frequent occurrence, theoretically, channel shifting resulting from gravel extraction might have less of an overall impact because it is analogous to a naturally occurring process (Follman 1980). In addition, floodplain width progressively decreases in the aforementioned series of river systems. If gravel extraction is to occur in the adjacent floodplain, it is likely that the other four channel-types will experience greater environmental impacts than a braided river channel-type (Follman 1980).

Gravel removal quantities should be strictly limited so that gravel recruitment and accumulation rates are sufficient to avoid extended impacts on channel morphology and anadromous fish habitat. While this is conceptually simple, annual gravel recruitment to a particular site is, in fact, highly variable and not well understood. (Recruitment is the rate at which bedload is supplied from upstream to replace the extracted material.) Kondolf (1993, 1994b) dismisses the common belief that instream gravel extraction can be conducted safely so

long as the rate of extraction does not exceed the rate of replenishment. He also states that this approach to managing instream gravel extraction is flawed because it fails to account for the upstream/downstream erosional effects that change the channel morphology as soon as gravel extraction begins. In addition, he reiterates that flow and sediment transport for most rivers and streams is highly variable from year-to-year, thus an annual average rate may be meaningless. An "annual average deposition rate" could bear little relation to the sediment transport regimes in a river in any given year. Moreover, sediment transport processes are very difficult to model, so estimates of bedload transport may prove unreliable. These problems and uncertainties indicate a need for further research.

Gravel bar skimming should only be allowed under restricted conditions. Gravel should be removed only during low flows and from above the low-flow water level. Berms and buffer strips must be used to control stream flow away from the site. The final grading of the gravel bar should not significantly alter the flow characteristics of the river during periods of high flows (OWRRI 1995). Finally, bar skimming operations need to be monitored to ensure that they are not adversely affecting gravel recruitment downstream or the stream morphology either upstream or downstream of the site. If the stream or river has a recent history of rapidly eroding bars or stream bed lowering, bar skimming should not be allowed.

Pit excavations located on adjacent floodplain or terraces should be separated from the active channel by a buffer designed to maintain this separation for two or more decades. As previously discussed, the active channel can shift into the floodplain pits, therefore Kondolf (1993, 1994a) recommends that the pits be considered as potentially instream when viewed on a time scale of decades. Consequently, buffers or levees that separate the pits from the active channel must be designed to withstand long-term flooding or inundation by the channel.

Prior to gravel removal, a thorough review should be undertaken of potentially toxic sediment contaminants in or near the stream bed where gravel removal operations are proposed, or where bed sediments may be disturbed (upstream and downstream) by the operations. Also, extracted aggregates and sediments should not be washed directly in the stream or river or within the riparian zone. Turbidity levels should be monitored and maximum allowable turbidity levels for anadromous fish and their prey should be enforced.

Removal or disturbance of instream roughness elements during gravel extraction activities should be avoided. Those that are disturbed should be replaced or restored. As previously stated, instream roughness elements, particularly LWD, are critical to stream ecosystem functioning.

Gravel extraction operations should be managed to avoid or minimize damage to stream/river banks and riparian habitats. Gravel extraction in vegetated riparian areas should be avoided. Gravel pits located on adjacent floodplain should not be excavated below the water table. Berms and buffer strips in the floodplain that keep active channels in their original locations or configurations should be maintained for two or more decades. Undercut and incised vegetated banks should not be altered. LWD in the riparian zone should be left undisturbed or replaced when moved. All support operations (e.g. gravel washing) should be done outside the riparian zone. Gravel stockpiles, overburden and/or vegetative debris should not be stored within the riparian zone. Operation and storage of heavy equipment within riparian habitat should be restricted. Access roads should not encroach into the riparian zones.

The cumulative impacts of gravel extraction operations to anadromous fishes and their habitats should be addressed by the federal, state, and local resource management and permitting agencies and considered in the permitting process. The cumulative impacts on anadromous fish habitat caused by multiple extractions and sites along a given stream or river are compounded by other riverine impacts and land use disturbances in the watershed. These additional impacts may be caused by river diversions/impoundments, flood control projects, logging, and grazing. The technical methods for assessing, managing, and monitoring cumulative effects are a future need outside the scope of this gravel policy. Nevertheless, individual gravel extraction operations must be judged from a perspective that includes their potential adverse cumulative impacts. This should be a part of any gravel extraction management plan.

An integrated environmental assessment, management, and monitoring program should be a part of any gravel extraction operation, and encouraged at federal, state, and local levels. Assessment is used to predict possible environmental impacts. Management is used to implement plans to prevent or minimize negative impacts. A mitigation and restoration strategy should be included in any management program. Monitoring is used to determine if the assessments were correct, to detect environmental changes, and to support management decisions.

Mitigation and restoration should be an integral part of the management of gravel extraction projects. Mitigation should occur concurrently with gravel extraction activities. In terms of National Environmental Policy Act (NEPA) regulations, mitigation includes: 1) avoidance of direct or indirect impacts or losses; 2) minimization of the extent or magnitude of the action; 3) repair, rehabilitation or restoration of integrity and function; 4) reduction or elimination of impacts by preservation and maintenance; and 5) compensation by replacement or substitution of the resource or environment. Thus, restoration is a part of mitigation, and the aim of restoration should be to restore the biotic integrity of a riverine ecosystem, not just to repair the damaged abiotic components. An overview of river and stream restoration can be found in Gore et al. (1995). Koski (1992) states that the concept of stream habitat restoration as applied to anadromous fishes is based on the premise that fish production increases when those environmental factors that limit production are alleviated. Thus, an analysis of those "limiting factors" is critical to the restoration process. He further states that effective stream habitat restoration must be holistic in scope, and approached through a three-step process:

- first, a program of watershed management and restoration must be applied to the watershed to ensure that all major environmental impacts affecting the entire stream ecosystem are addressed (i.e. cumulative impacts). Obviously, an individual gravel extraction project is not expected to restore an entire watershed suffering from cumulative effects for which it was not responsible. Rather, needed mitigation and restoration activities in a riverine system should focus on direct and indirect project effects and must be designed within the context of overall watershed management;

- next, restore the physical structure of the channel, instream habitats and riparian zones (e.g. stabilize stream banks through replanting of riparian vegetation, conserve spawning gravel, and replace LWD). This would reestablish the ecological carrying capacity of the habitat, allowing fish production to increase; and

- finally, the fish themselves should be managed to ensure that there are sufficient spawning populations for maximizing the restored carrying capacity of the habitat.

NMFS recommends that either a mitigation fund, with contributions paid by the operators, or royalties from gravel extraction be used to fund the mitigation and restoration programs as well as for effectiveness monitoring.

Habitat protection should be the primary goal in the management of gravel extraction operations. Resource management agencies acknowledge that, under the right circumstances, some gravel extraction projects, whether commercial or performed by the agencies themselves, may offer important opportunities for anadromous fish habitat "enhancement". That is, gravel removal itself can be used beneficially as a tool for habitat creation, restoration, or rehabilitation (OWRRI 1995). However, stream restoration and enhancement projects should be regarded with caution. While it is tempting to promote gravel extraction as a means to enhance or restore stream habitat, the underlying objective of this gravel policy is to prevent adverse impacts caused by commercial gravel extraction operations. Therefore, gravel extraction for habitat enhancement purposes done in conjunction with commercial gravel operations will not take precedence over, and is not a substitute for, habitat protection.

Suction Dredging

The Department requires a permit to use any vacuum or suction dredge equipment in any river. Strict adherence to the regulations and requirements pursuant to Section 5653 of the Fish and Game Code is necessary to prevent impacts to salmonids and their habitat. Considering the uncertainty surrounding dredging effects, declines in many aquatic animal populations, and increasing public scrutiny of management decisions, the cost of assuming that human activities such as dredging cause no harm deserves strong consideration by decision makers (Mapstone 1995). Dayton (1998) suggests that, where threatened or endangered species exist, managers need to assume activities such as dredging are harmful unless proven otherwise.

Habitat Restoration and Watershed Management

Introduction

Restoration of California's anadromous fish populations has been supported by private, local and state interests for many years. The Salmon, Steelhead and Anadromous Fisheries Program Act of 1988 and other programs have generated considerable restoration efforts initiated at the local level.

Restoration of coho salmon populations requires restoration of watersheds, restoration of instream habitat, and restoration of species. Watershed restoration focuses on sustaining the appropriate environmental conditions and ecological processes that influence streams and rivers. Stream restoration focuses on sustaining and enhancing fish habitat. A potential fishery restoration project may include instream fish habitat improvement structures, riparian zone revegetation, bank stabilization, and/or upslope improvements such as road rehabilitation or decommissioning.

Increased development and incompatible land uses can negate existing protections and restoration actions for key coho salmon habitat. This is especially important for riparian lands that have water rights, stream reaches that support depressed native stocks, and estuaries. Establishing conditions, constraints, and practices to maintain watershed integrity and restoring problem areas that degrade or block aquatic habitat are of the utmost importance.

In 1994, the Department developed a "*Coho Salmon Habitat Impacts, Qualitative Assessment Technique for Registered Professional Foresters*," (CDFG 1994b). This was in response to a request by the BOF to assist in determining the cumulative impact of timber harvest and to design mitigation measures. The method involves information gathering, site analysis, and looking for forensic evidence of past problems. The Department uses a habitat assessment method described in the "*California Salmonid Stream Habitat Restoration Manual*" (Flosi et al. 1998) to assess the condition of stream habitats and determine the need for restoration projects.

Restoration Programs

California Department of Fish and Game's Fishery Restoration and Grants Program: The Department, through the Fishery Restoration Grants Program (FRGP), restores or enhances salmon and steelhead habitat throughout the anadromous waters of California. Restoration projects generally consist of rearing and spawning habitat restoration, bank stabilization projects (using bioengineering techniques), and riparian and upslope projects. Upslope projects largely consist of activities directed toward road improvements to alleviate sediment delivery to water courses, and revegetation of hill slopes to alleviate erosion. In addition, the FRGP provides funding for projects that will lead to salmon and steelhead habitat protection and restoration such as public school and technical education, research that will advance the science of restoring anadromous salmonids, monitoring to determine trends, watershed organization support, and planning and assessment. All restoration projects conducted under the FRGP are constructed using methods and procedures described in the Department's "*California Salmonid Stream Restoration Manual*" (Flosi et al. 1998)

Funding is provided through various account sources managed by the Department, such as Commercial Salmon Stamp, Steelhead Trout Catch Report-Restoration Card, Salmon and Steelhead Restoration, Proposition 271 funds, and accounts managed by the Wildlife Conservation Board. Grants can be made for: instream, watershed and riparian habitat restoration; watershed evaluation, assessment, and planning; project maintenance and monitoring; watershed organization support and assistance; private sector technical training and education projects; California Forest Improvement Program (CFIP) projects; cooperative fish rearing; and public education, including watershed and fishery conservation education projects. The Department solicits potential projects through a Request for Proposals which is distributed in February of each year. Total funds granted and number of projects funded since the FRGP began is shown in Table 22.

Coastal Watershed Restoration Program: SB 1087 (Salmon and Steelhead Trout Restoration Account), was passed and signed by the Governor in 1997. This bill earmarked $43 million over six years ($3 million in FY 1997/98 and $8 million for each of the following five years) for anadromous fisheries habitat restoration and watershed planning efforts. The Department developed a coastal watershed restoration program startup plan for this effort to

coordinate efforts of all state agencies that have programs that protect or help to restore anadromous fish habitat. Key elements of this plan include:

- Establishing statewide and watershed-specific recovery goals.
- Developing a coast-wide watershed planning interface with local watershed groups, city, county, and state agencies, and tribal governments.
- Developing measurable targets to assess fishery and watershed recovery.
- Developing watershed assessment plans and implementation plans to accomplish goals.
- Establishing a clearinghouse to review restoration contract and grant proposals from all funding sources to avoid project duplication and to focus activities into high priority areas.
- Establishing an integrated technical information system to collect fish and habitat information for baseline conditions and trend analysis.
- Developing an adaptive management ethic for all restoration activities.

Table 22. Total funds granted and number of projects funded through the Department's Fishery Restoration Grants Program, 1981 to present.

FISCAL YEAR	AMOUNT APPROVED	TOTAL No. PROJECTS
1981/1982	$611,670	16
1982/1983	$856,574	70
1983/1984	$1,465,287	90
1984/1985	$1,810,998	98
1985/1986	$6,862,758	168
1986/1987	$6,114,120	123
1987/1988	$2,678,885	108
1988/1989	$2,974,171	111
1989/1990	$3,522,223	104
1990/1991	$2,248,405	96
1991/1992	$3,382,935	111
1992/1993	$3,601,442	140
1993/1994	$3,313,297	161
1994/1995	$1,596,221	173
1995/1996	$1,568,305	160
1996/1997	$1,776,842	117
1997/1998	$4,726,373	221
1998/1999	$6,062,498	257
1999/2000	$7,323,887	178
2000/2001	$20,458,701	301
TOTAL	$82,955,592	2803

Americorps Watershed Stewards Project (WSP): WSP is a comprehensive community-based watershed restoration and education program, established in 1994. The WSP mission is to conserve, restore, and sustain anadromous watersheds for future generations by linking high-quality scientific practices with education. The 53 WSP members are recruited from colleges throughout the United States and are assigned to serve with 25 resource professionals from state, federal, local and non-profit agencies.

Gravel restoration projects: In cooperation with the Department, the California Department of Water Resources (DWR) - Northern District has carried out major salmon spawning gravel restoration projects on the Trinity and Klamath rivers. These projects were intended to restore salmon spawning gravel below dams.

Urban Streams Restoration Program: The Urban Streams Restoration Program was established by DWR to address flooding and erosion on urban streams using environmentally-sensitive methods. The program provides grants for projects that clean-up streams, stabilize banks, and improve riparian habitat in urban areas. Project benefits include reduced bank erosion and reduced sedimentation downstream, increased canopy cover, improved water quality, and improved summer flows. Since the program began in 1985, it has provide a total of $9,374,057 for projects throughout the range of coho salmon.

California Conservation Corps (CALCC): The CALCC has performed several million dollars of reimbursement work for the Department, USFWS, the Wildlife Conservation Board, Americorps, and numerous local fisheries management agencies. In addition, funding from Proposition 204 provided the CALCC with additional fisheries projects. CALCC has received over $7 million for fisheries restoration work through the Department's FRGP

From 1981 to 2000, the CALCC has undertaken restoration projects on over 720 miles of tributaries to the Eel, Van Duzen, Mattole, Russian, and South Fork Trinity rivers, tributaries to Humboldt Bay, and numerous coastal streams. Barriers have been modified in 200 streams, nearly five miles of stream bank have been stabilized in 90 streams, over 2,700 instream structures have been constructed in 100 streams, and approximately 1,330,000 trees have been planted in the riparian zone of 120 streams. These projects have resulted in stream habitat improvements such as more numerous and deeper pools, restoration of spawning gravel, and increased canopy.

Klamath River Basin Conservation Area Restoration Program: The Klamath River Basin Conservation Area Restoration Program was authorized by Congress in 1986 under Public Law 99-552 (also known as the Klamath Act). The goal of this program is to restore the anadromous fisheries of the Klamath Basin. The Klamath Act authorized $21 million for the program. It also created two advisory committees, the Klamath River Basin Fisheries Task Force (Task Force) and the Klamath Fishery Management Council (Council), to help guide the program. These two advisory committees consist of members representing federal, state, county, and tribal governments, as well as commercial fishing and angling groups.

The Task Force has developed and implemented a long-range plan for restoring anadromous salmonids, based largely on restoration of key habitats and watersheds in the basin. From the beginning, the Task Force has funded locally-managed subbasin groups like the Scott River Watershed Council, the Salmon River Restoration Council, and the Shasta River

Coordinated Resource Management Planning (CRMP) group to identify restoration needs and implement projects. The Task Force has also provided funding to local watershed groups to help develop subbasin restoration plans. To date, more than $7.7 million has been provided for watershed restoration projects such as riparian restoration, livestock exclusion, road decommissioning and fishery monitoring.

The Council has developed a long-term plan for the management of in-river and ocean harvest of Klamath anadromous fish. The Council provides annual advice to the Pacific Fishery Management Council (PFMC) and state and tribal regulatory agencies on necessary spawning escapements and allowable harvest levels for fall-run chinook salmon in the Klamath Basin.

Trinity River Basin Fish and Wildlife Task Force: Following completion of the Trinity River Project in 1963, fish populations in the Trinity River declined significantly. To reverse this decline, a 13-agency Trinity River Basin Fish and Wildlife Task Force was formed in 1974, and state and federal funds were budgeted to define problems, develop solutions and begin restoring the river.

Trinity River Basin Fish and Wildlife Restoration Program: In October 1984, Congress passed PL 98-541, which authorized the Trinity River Basin Fish and Wildlife Restoration Program. This act provided $57 million (in addition to the Buckhorn Mountain Debris Dam on Grass Valley Creek) to implement actions needed to restore fish and wildlife populations in the Trinity River Basin.

The Trinity County Resource Conservation District (RCD) initiated and manages the 36 square-mile Grass Valley Creek watershed project through a CRMP. Fourteen state, federal, and local agencies, including USBR and USFS, are partners with the RCD. Agency funding support has totaled more than $5 million over five years. In addition, several industrial timber companies have joined the partnership and contributed resources.

The RCD has facilitated a buyout of Champion Lumber Company's timberland by BLM, which has assumed ownership and management responsibilities. As of 1995, 10,000 acres had been treated for erosion at about 800 sites using 490,000 trees, shrubs and grass plugs, and 62 miles of roads have been reconstructed to acceptable standards or decommissioned. The project is a model of locally-led conservation involving productive partnerships with agencies and private property owners at all levels.

Watershed Management Planning

Development of a watershed management plan requires an understanding of the relationship between causes and effects throughout a watershed to comprehensively and qualitatively link watershed activities to impacts on resources. Ideally, a plan will identify historical effects of sediment, water, heat, wood and nutrient inputs and define how these are related to natural processes such as hydrology, riparian function and energy transfer (heat and hydrologic) in a watershed. Ultimately, these relationships form the basis of a watershed model which can be used as a predictive decision-making tool for fishery restoration projects. The keystone of the watershed approach is local leadership and commitment, involvement by all stakeholders, and support and guidance from state and federal governments. Through the State's

participation in "For Sake of the Salmon," federal funds have been secured for grants to watershed groups to hire coordinators. Several watershed planning efforts are described below.

Eel River watershed: The Eel River watershed is located in highly erodible soils in the steep coastal mountains of the North Coast. The watershed is heavily forested and is widely managed for timber production. The watershed is lightly populated. Domestic and agricultural are the primary uses of developed water.

Many of the most dramatic changes and watershed disturbances to the Eel River have occurred within the last 50 years. Land and water development projects including logging, mining, road construction, dam construction, grazing, cultivation, residential development, urbanization and water diversions have directly or indirectly reduced or adversely altered habitat conditions for coho salmon.

Problems and issues in the watershed include:

- Excessive watershed erosion;
- degraded stream and riparian habitat;
- water diversions causing low stream flows;
- poor migration access for adults and juveniles;
- Eel and Van Duzen rivers are listed on the CWA 303(d) list of impaired streams with sedimentation identified as a pollutant affecting anadromous fish;
- concerns regarding solid waste disposal;
- concerns about dairy industry and grazing impacts;
- mercury in Lake Pillsbury (largemouth bass at concentrations approaching standards for fish flesh consumption);
- regulation of gravel extraction;
- possible impact to the river by road repairs and slides;
- timber harvesting practices;
- Potter Valley Diversion; and
- predation by introduced species such as the Sacramento pikeminnow

Efforts to address problems include:

- Formation of Eel River Watershed Improvement Group.
- Continued adherence to the North Coast Region Basin Plan which contains specific objectives and implementation programs to protect and enhance area waters, specifically federal waste discharge permits.
- Continued enforcement of policies regarding individual wastewater systems, which provides guidelines for local agency jurisdictions to prevent water degradation from septic systems.
- Continuing efforts to coordinate watershed protection efforts with local agencies and groups and appropriate state and federal organizations.

To address the issues within the Eel River Basin, the Department established a basin planner position in 1991 to work with local landowners. To date, the program has been explained to over 3,000 landowners and most of them have granted permission to survey their streams and plan restoration projects. Additionally, an ongoing series of public forums and

workshops have been held to solicit ideas and concerns from the basin's landowners and managers, and other interested citizens and groups. This information, along with field assessment data, was used to develop an Eel River Action Plan.

The Eel River Action Plan provides specific actions to address problems. Fishery and watershed information was integrated with observations and concerns from citizens and basin stakeholders. This provided the assessment of present conditions, identification of current problems and recovery opportunities related to Eel River salmon and steelhead resources. The elements of this plan address salmon and steelhead problems throughout the Eel River basin. The primary goals of the action plan are: 1) halt the long-term decline in salmon and steelhead populations within the Eel River; and 2) significantly increase those populations above current levels. Dedicated efforts should improve watershed and stream conditions to a level that can be maintained for the long-term, on the basis that full watershed stewardship is adopted by landowners and resource users. Cooperative programs within the Eel River involve the RCDs in Mendocino and Humboldt counties.

The PALCO cooperative fishery program operated from 1991 through 1999 on PALCO lands in the lower mainstem Eel and Van Duzen rivers. The program was much reduced with the advent of the company's current HCP, which took over many of the fisheries program elements.

The Mendocino RCD has worked on the Tomki and Dooley watersheds, located in the upper mainstem Eel River watershed. It has assessed and prioritized five additional watershed projects. Significant erosion treatments are being applied to streambed degradation. Bioengineering practices, integrating vegetation and structural designs are being used to solve stream bank problems. Within the Tomki Creek watershed, Mendocino RCD has completed several riparian revegetation and bank stabilization projects. The Mendocino RCD has also begun similar work in the Tenmile Creek watershed.

Garcia River Watershed: Land use activities in the Garcia River watershed include timber harvesting, grazing, gravel extraction and agriculture. Significant floods also impact the geomorphic, sediment transport, and biological characteristics of the river.

Problems and issues in the watershed include:

- Garcia River is on CWA 303(d) list for impairment due to sedimentation;
- high water temperatures are an issue in some tributaries and/or sections of the Garcia River.
- the estuary has decreased in size due to sedimentation.
- gravel mining is a concern in the lower Garcia River.
- solvents, petroleum and metals have been detected in groundwater and surface water at the U.S. Air Force's Point Arena Station.

Efforts to address the problems include:

- Cleanup activities continue at Point Arena Station.
- Developing TMDL plan to reduce sedimentation and water temperatures in mainstem and tributaries and improve habitat conditions.
- Mendocino County Water Agency has developed a gravel management plan.

- Court settlement following a bentonite spill into a Garcia River tributary is being used for stream rehabilitation.
- Adopt-a-Watershed education program is active in area schools.
- Coastal Forest Lands, a timber company owning most of the North Fork Garcia River watershed, is developing a SYP which includes watershed management components.
- SWRCB and USEPA have provided a grant for a contract employee from USEPA to develop a 303(d) waste reduction strategy.
- CDF has targeted the Garcia River for pilot long-term FPR monitoring program.

The Mendocino RCD received a $100,000 grant from the California Coastal Conservancy to develop a watershed enhancement plan for the Garcia River, near Point Arena. The goal of the plan is to gather information needed to improve the resources of the river. A contract was executed to survey the watershed, collect data, and analyze existing problems. A key part of the plan is to understand and respond to the needs and visions of the landowners and the Garcia River community.

Russian River-Bodega Bay watershed:. The Russian River-Bodega Bay watershed is in erosive topography and is sensitive to land disturbance. Summer flows are often restricted to isolated areas due to numerous water diversions by agricultural and domestic users.

In the Potter Valley area north of Ukiah, irrigated cultivated agriculture and irrigated pasturing are common. Around Ukiah, irrigated orchard and vineyards are common land uses with light industrial and three large mills associated with the timber industry. The Hopland area is predominantly vineyard, with rangeland grazing in the areas away from the mainstem. South of Hopland, the Russian River flows through a small canyon, with rangeland as the primary land use, before reaching Cloverdale and more vineyards. Vineyards predominate the valley areas down to the Santa Rosa Plains. Hillside vineyard development is on the increase, replacing rangeland upslope from the mainstem Russian River. The Santa Rosa Plains, Alexander Valley, and Healdsburg geologic subunits contain large groundwater basins that supply water for municipal, domestic, and agricultural uses.

The Santa Rosa Plains contains a large concentration of confined animal operations, including almost 100 dairies. There are currently 29 active dairies in the Mark West Creek (Laguna de Santa Rosa) watershed. Conversion of rangeland pasture and orchards to vineyard has increased significantly in the last decade. The reclaimed wastewater from the City of Santa Rosa's subregional municipal waste treatment facility also has resulted in conversion of rangeland to irrigated pasture and cultivated fodder crops.

The Santa Rosa Plains area is the most populated, with six incorporated municipalities and over 200,000 residents in the area (1990 U.S. Census). Two former defense sites are located in the Santa Rosa Plains along with numerous small to large industrial sites. A number of large river terrace pit-type gravel mines are located downstream of Healdsburg.

Trends in land-use appear to be towards continued conversion of lands to vineyards (increasing onto hillsides), and continued growth of the urban areas of Ukiah, Cloverdale, Healdsburg, Windsor, Santa Rosa and Rohnert Park. Associated with growth are active construction sites and an increase in light industrial operations. A concerted effort is being made

in the Santa Rosa Plains to retain the reclaimed wastewater irrigated crop and pastureland type of agriculture and maintain the viability of the dairy industry. Significant conversion of pasture to vineyards has occurred in the area.

Problems and issues in the watershed include:

- storm water runoff from agricultural, urban, industrial and construction sites;
- tertiary wastewater treatment levels are needed at all nine urban areas in this watershed, currently only three use tertiary treatment;
- high septic system failure rate at various western Sonoma County locations;
- unpermitted discharges;
- erosion from vineyards;
- confined animal facilities contribute nitrogen, phosphorus, organic matter and sediment loads to watershed;
- pesticide and fertilizer use in orchards, vineyards, turf farms and urban areas;
- mercury accumulation in fish tissue in lakes Pillsbury, Mendocino, and Sonoma are approaching California Department of Health Services (DHS) warning levels for fish consumption;
- abandoned mercury mines in Big Sulphur and Fife Creek drainages;
- modified flows out of the two federal dams impact spawning habitat and decrease stability of banks and riparian canopy;
- unimproved public (county) and private roads contribute sediment and block passage at culverts;
- the estuary is managed primarily for flood control purposes, and frequent artificial breaching reduces rearing habitat for juvenile salmonids; and
- gravel mining in excess of mainstem recruitment has destabilized most tributaries, resulting in diminished pool depth and quality.

Efforts aimed at improved coordination and ecological restoration are scattered throughout the watershed. The involvement spans a breadth of agencies and local groups from the USACE to state agencies and local groups. Some specific efforts include:

- ESA Section 7 consultation with the Sonoma County Water Agency and the USACE regarding operation of dams.
- Sotoyome RCD's watershed stewardship efforts and the Fish Friendly Farming incentive project that focus on a profit incentive program for farmers who meet environmental goals beyond regulatory ones.
- City of Santa Rosa's dairy waste management grant program.
- North Coast RWQCB's watershed planning approach for water quality (grassroots effort that includes volunteer monitoring).
- Department and USACE sponsored Russian River Watershed Council.
- Sotoyome RCDs Fish Friendly Farming program aimed at reducing vineyard impacts.

Each of these efforts is aimed at achieving specific goals, while being consistent to varying degrees with the broader goal of salmonid protection and restoration. However, there is a need to improve coordination and cooperation to avoid duplication and assure that individual

actions are consistent with a broader mission. Likewise, there is a need to ensure that other watershed activities are not at cross-purposes with the restoration goals.

In addition to the above, the Department has recently released the *Draft Russian River Restoration Plan*. The goals of this plan are:

- Identify and prioritize "keystone" factors which in themselves may restore functionality to watershed systems or lifecycle patterns;
- Prioritize keystone management changes to be implemented by local, state and federal agencies and districts;
- Prioritize keystone projects to be considered for funding by local, state and federal funding organizations;
- Prioritize and encourage lower priority projects to be undertaken by private landowners that provide shorter term, but needed benefits;
- Encourage demonstration projects that demonstrate fish-friendly techniques and Best Management Practices (BMPs); and
- Engage and support an active citizenry and local government in a partnership for restoration and "stewardship" in management.

Napa River watershed: The Napa River watershed encompasses approximately 210 square miles. The river is presently intermittent in the northern reach; it then becomes perennial due to groundwater discharge. The Napa River is a significant tributary to San Francisco Bay, and is included in the 303(d) list of impaired waterbodies due to siltation, nutrients and pathogens. There are approximately 240 wineries in Napa County.

Problems and issues in the watershed include:

- Agricultural runoff;
- erosion control;
- urban runoff;
- wetlands loss;
- wastewater discharges.

In 1994, the Napa RCD and stakeholders produced the *Napa River Valley Owners Manual*, an integrated resource management plan. The Napa RCD has stewardship programs in up to seven creeks in this watershed. A sustainable viticulture group of stakeholders is producing a BMPs manual. The Napa RCD has facilitated a stakeholder group that developed BMPs for orchard heaters.

Napa County has an erosion control ordinance for both new and replanted vineyards and land grading where slope exceeds 5 percent. Strategic enforcement of this ordinance is planned. The Napa RCD, Napa County, and CDF are seeking to resolve issues related to converting forestlands to vineyards. The San Francisco Bay RWQCB is working with Napa municipalities to improve management of new development and is requiring appropriate BMPs.

San Francisco Bay watershed: San Francisco Bay has been reduced by about 40% from its original size due to sedimentation. The San Francisco Bay estuarine system marks a natural topographic separation between the northern and southern coastal mountain ranges. The

watershed's waterways, wetlands and bays are at the center of the United States' fourth-largest metropolitan region, including all or major portions of Alameda, Costa Contra, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano and Sonoma counties.

Water quality in the San Francisco Bay system is impacted by several factors. For example, the presence of elevated concentrations of toxic pollutants in the bays, from both point and nonpoint sources, has caused them to be listed as impaired water bodies. DHS has issued health advisories on the consumption of the Bay's fish and certain waterfowl due to their elevated levels of selenium and other metals.

The San Francisco Bay Estuary Project developed the Comprehensive Conservation and Management Plan in 1993. Implementation of the Comprehensive Conservation and Management Plan's 140-plus recommended actions is underway. Actions address erosion control, vessel waste, invasive species, pollution prevention, urban runoff, watershed management planning, and the wetlands ecosystem goals project.

The CALFED Bay-Delta Program is a consortium of federal and state agencies working to restore ecological health and improve water management for beneficial uses of the San Francisco Bay and Sacramento-San Joaquin River Delta estuary.

Santa Clara Basin: The Santa Clara Basin encompasses the areas of Santa Clara County that drain into the south San Francisco Bay. The Santa Clara Valley consists of 11 sub-basins, including the Coyote Creek watershed on the east side, the Guadalupe River that drains the south-central portion of the valley, and a series of small, relatively urbanized watersheds that drain the west side. The planning area has a population of some 1.3 million and is mostly urbanized.

Problems and issues in the watershed include:

- A dense population in a small area;
- The extreme south portion of San Francisco Bay is poorly flushed, causing water quality criteria to be exceeded for certain toxic pollutants;
- Aquatic/riparian habitats are in various states of degradation;
- Several reservoirs and streams are impaired due to mercury levels.

The San Francisco Bay RWQCB initiated a watershed management effort in the Santa Clara Basin in 1996. Local agencies and environmental and community organizations are implementing a watershed management planning process. In 2001, the City of San Jose issued a *Santa Clara Basin Watershed Management Initiative and Watershed Management Plan* that addresses: habitat and water quality protection and enhancement; water rights and water supply reliability; flood management; regulatory compliance; land use; and public awareness and involvement.

Workgroups and Partnerships Programs

North Coast Watershed Assessment Program (NCWAP): In 1999, the California Resources Agency and the California Environmental Protection Agency began developing an interagency watershed assessment program for California's north coast. The purpose of the

program is to develop consistent, scientifically credible information to guide landowners, agencies, watershed groups, and other stakeholders in their efforts to improve watershed and fisheries conditions.

Participating agencies include: the Department, CDF, CGS, DWR, and the North Coast RWQCB. NCWAP is designed to meet four goals:

- Develop baseline information about watershed conditions;
- Guide watershed restoration programs;
- Guide cooperative interagency, non-profit, and private sector approaches to protect the best through stewardship, easement, and other incentive programs;
- Better implement laws requiring watershed assessments such as Forest Practices, Clean Water and Porter-Cologne Acts, Lake or Streambed Alteration Agreement, and others.

The program provides a process for collecting and analyzing information to answer a set of questions designed to characterize current and past watershed conditions. It will cover approximately 6.5 million acres of private and state lands within the 12 million acre North Coast Hydrologic Region. Information will be used to guide watershed management and restoration planning, restoration and recovery planning for anadromous fisheries, and implementation of watershed protection policies and regulations.

NCWAP will provide information that small landowners can not easily obtain, such as landslide, sediment, and THP maps for all ownerships within a watershed. These products, when used in conjunction with site specific assessments, will improve the ability to design projects that mitigate potential watershed impacts and address limiting factors to salmonid recovery. NCWAP will also work with interested landowners to demonstrate the use of GIS tools and predictive models for project planning and cumulative effects analysis.

NCWAP will provide data sets and databases, maps and GIS data, topical reports, and an overall summary with recommendations for every basin. Products will include photos and maps of current land use, landslide locations and risk, sediment distribution in streams, and 60 years of timber harvest history. NCWAP will compile data on instream channel and riparian conditions, fish populations, and water quality, and develop new data as feasible. It will analyze sediment transport and the effects of land use history on vegetation change, watershed disturbance, and instream habitat. The Department will use this information to analyze limiting factors for salmonid protection and habitat restoration.

Coordinated Resource Management Planning (CRMP): CRMP is a problem-solving management process that allows for direct participation of those concerned with natural resource management in a given area. CRMP coordinates resource management strategies to improve resource management and minimize conflicts among land users, landowners, government agencies, and interest groups.

CRMP encourages sharing responsibilities and resources through the cooperative implementation of projects. The ultimate goal of CRMP is to protect, improve, and maintain natural resources. The objective of each CRMP effort is to develop and implement a unified program of action for resource use and management that minimizes conflict.

Resource Conservation Districts (RCDs): In 1937, Congress passed the Standard State Conservation District Law that encouraged states to form special districts to address growing problems of soil erosion and watershed management. California responded in 1938 with the addition of Division 9 to the state's Public Resources Code, which enabled the formation of Soil Conservation Districts (later renamed Resource Conservation Districts) as special districts with limited powers to levy property taxes. There are 103 RCDs in California, covering about 85% of the total area of the state, that plan and implement watershed restoration and enhancement projects throughout the state.

Cooperative county efforts: Del Norte, Siskiyou, Trinity, Humboldt, and Mendocino counties are coordinating to address the issues brought about by the listing of anadromous fish species under the ESA (known as the "The Five-County Effort"). Also, five counties (Mendocino, Sonoma, Marin, San Mateo and Santa Cruz) within the CCC Coho ESU are pursuing a similar cooperative effort. The purpose of these efforts is to provide regulatory stability for small landowners and local agencies until long-term planning and recovery efforts of the state and federal government is accomplished. The Resources Agency and NMFS has provided financial support for the groups. Working in coordination with State and federal agencies, the counties have developed and are now implementing work plans for the protection and restoration of anadromous salmonids.

The Five-County Effort has an adopted work plan that provides for a comprehensive review and coordination of county level land-use regulations and practices as they relate to anadromous salmonid fisheries habitat within coastal watersheds of the five counties. This effort: 1) establishes a Memorandum of Agreement that will provide for cooperative planning and restoration efforts among the counties; 2) assesses the adequacy of existing General Plan policies, zoning, subdivision and other land-use ordinances; 3) reviews county management practices that affect anadromous salmonid habitat in each county; 4) recommends changes to county ordinances and/or practices as necessary; 5) develops a watershed based education/training program for local agencies and decision makers that will foster better understanding between land use and maintenance practices and salmonid habitat; and 6) provides a linkage between this short-term planning effort and long-term efforts.

Monterey, Santa Cruz, San Mateo, Marin, Sonoma, and Mendocino counties have established the "Fishery Network of Central California Coastal Counties" *(*FishNet 4C). FishNet4C's goals are to facilitate effective local actions that will maintain or improve the region's water quality and riparian habitat, provide increased assistance and education for local government and the private sector, and encourage cooperation and coordination among all levels of regulatory responsibility for fishery restoration. The program seeks to accomplish these goals through a process of evaluating existing activities, recommending model programs, tracking legislation, soliciting outside funding, and increasing communications among interested agencies and the public.

The Watershed Management Council: The Watershed Management Council is a non-profit organization formed in 1986. Membership includes professionals, students, teachers, and individuals from 28 states and 3 countries whose interest is in promoting proper watershed management. Activities of the Watershed Management Council include:

- Providing a forum for the integration of knowledge from a wide array of technical disciplines;
- Periodically summarizing the state of knowledge and technologies of watershed management;
- Identifying research needs and priorities;
- Membership training;
- Encouraging appropriate policies and legislation relating to watershed management;
- Stimulating the transfer, interchange, and dissemination of current data and technology;
- Providing a forum for discussion of social and economic ramifications of watershed management;
- Networking with other organizations related to watershed management;
- Recognition of significant contributions to knowledge or management of watersheds;
- Promotion of public awareness of the importance of appropriate watershed management.

Smith River Advisory Council : The Smith River Advisory Council (SRAC) is an independent group of representatives from city, county, state, and federal agencies, fishing and environmental organizations, Smith River watershed resource users, and industry. The purpose of the SRAC is to actively promote forums that answer questions and solve problems concerning Smith River fisheries. This purpose also involves cooperatively supporting a system-wide approach towards watershed management in the Smith River basin.

The goals of the SRAC include:

- Coordinate and integrate fishery research and enhancement efforts proposed by government agencies, enhancement groups,and private industry on the Smith River.
- Pursue funding sources to facilitate research and enhancement efforts on the Smith River.
- Encourage or provide forums and materials to help educate the public about fishery/watershed issues of the Smith River Basin.
- Facilitate the development of a Smith River fishery management plan that will benefit the biological, social, and economic aspects of the Smith River Basin and Del Norte County. This includes influencing legislation and regulation changes.

Representatives to the Council include the Department, Del Norte County, USFS, USFWS, California Trout, Smith River Alliance, sport anglers, Del Norte Fishermen's Marketing Association, Lily Bulb Growers, Reservation Ranch, California Department of Parks and Recreation (CDPR), University of California Sea Grant, Humboldt State University, River Guides Association, gravel extractors, dairy farmers, Stimson Lumber Company, CALCC, Rowdy Creek Hatchery, Bar-O Boys Ranch, Redwood National Park, Rural Human Services, private consultants, River Institute, private citizens, Native American groups, and Friends of Del Norte.

Siskiyou Resource Conservation District and the Scott River Watershed Council: The Siskiyou RCD and the Scott River Watershed Council (SRWC) are two primary local entities working on resource management issues in the Scott River watershed. Together they have been developing and implementing projects and plans for the subbasin since 1992. The Siskiyou RCD was formed in 1949 and is one of five RCD's in Siskiyou County. It is governed by a five-member board consisting of local landowners. With technical assistance from the Natural Resource Conservation Service, the Siskiyou RCD develops and implements projects on private land.

In 1992, the Scott River Watershed CRMP committee was formed under the sponsorship of the Siskiyou RCD to develop cooperative solutions to anadromous fish problems in the basin. The Scott River Watershed CRMP was later changed to the SRWC. The primary focus of the SRWC's efforts is on voluntarily conserving and enhancing the natural environment. The Siskiyou RCD supports the SRWC by providing administrative assistance with contracts and grant funding.

Since 1992, over $3 million has been spent on projects that protect or enhance habitat for anadromous fish in the Scott Valley. Project types include instream structures, riparian planting and protection, fish screens, upland road inventories and road erosion reduction, water conservation, alternative stock water systems, monitoring, council coordination, planning, and education (SRWC 2001).

The Shasta River Coordinated Resource Management Planning Committee: The Shasta River CRMP was formed by the Shasta Valley Resources Conservation District in 1991. The goal of the CRMP is to identify and fix problems in the Shasta River that are reducing survival of anadromous fish. The CRMP membership is made up primarily of agricultural community and federal and state agency representatives. Administrative and contract assistance is provided by the Great Northern Corporation, a private, non-profit organization instead of the Shasta Valley Resources Conservation District.

Since 1992, over $3.3 million in projects have been completed or initiated to enhance habitat for anadromous fish in the Shasta Valley (Richard Christie, pers. comm.). Project types include:16 miles of livestock exclusion fencing, protection of riparian zones along the river, supplemental tree planting with native trees to help reduce water temperatures, off-stream water for livestock, bioengineered bank stabilization, fish screens, tailwater reuse, and improvements to irrigation diversion structures (SRCRMP 2001).

Restoration Incentive Programs

California Department of Forestry and Fire Protection's California Forest Improvement Program (CFIP): The purpose of CFIP is to encourage private and public investments in, and management of, forest lands and resources to ensure protection of all forest resources while providing for adequate future high quality timber supplies, related employment, and other economic benefits. The main emphasis is on small landowners with less than 5,000 acres of timberland. Cost-share is from 50% to 90%, depending on the type of assistance. Over one million acres are included in forest stewardship management plans. A 1986 study of the economic benefits of the CFIP program indicated that over $50 in economic activity is created for every state dollar spent for CFIP in rural areas.

Public Awareness and Support Programs

Watershed academy: Many of the state's salmon restoration programs require a high level of public awareness and support. The Department, CDF, SWRCB and the North Coast RWQCB co-sponsored a "watershed training academy" for agency staff and RPFs who conduct projects, advise landowners or approve permits. The academy was established in 1996, and 200 graduates participated in the program through 1999. The academy may be expanded to include landowners and local groups as funding becomes available. In 1997, co-sponsors included NMFS. Course content covers the technical aspects of:

- Salmonid life history and instream beneficial uses;
- watershed assessment and evaluation of cumulative effects (manuals supplied);
- recognition of potential impacts and high risk areas;
- hillslopes, roads, stream crossings, streamside zones and fish barriers;
- mitigation, protection and restoration methods; and
- monitoring theory and methods.

Department of Education's Environmental Education Grant Program (EEGP): The California Department of Education (CDE) works with the Resources Agency and Cal-EPA to promote educational opportunities relating to energy conservation, environmental protection, pollution effects, and the use of natural resources. The purpose of the EEGP is to assist kindergarten- to twelfth-grade students and teachers in achieving "environmental literacy" to understand fundamental ecological concepts, and to facilitate responsible action toward the environment.

EEGP provides four categories of comprehensive grants: mini-grants (up to $3,000), and implementation, site/facilities, and networking grants (up to $15,000). The CDE's Science and Environmental Education Unit coordinates the allocation of grant funds to schools and nonprofit agencies. Applicants must show proof of commitment through matching contributions and submit a proposal that convinces the Grant Review Committee and CDE that the project will continue to benefit the target audience after the state funds have been spent.

Inventory and Database Programs

Watershed Information Technical System (http://ceres.ca.gov/watershed/): The goal of this internet web site is to provide information and tools to support local watershed planning, restoration, monitoring, and education.

Habitat Inventory Database: The Department maintains the California Habitat Inventory Data Base. The primary purpose of performing habitat inventories is to assess the condition of a stream for potential restoration. The database converts information to maps showing where stream habitat inventories have been conducted by the Department since 1993. This type of data provides a basis for understanding the physical characteristics of instream habitat.

Other Programs

CDPR's Habitat Conservation Fund: Funding for a variety of habitat conservation projects is provided by the Habitat Conservation Fund. Eligible applicants include counties, cities, and districts. Eligible projects are those that: protect or enhance deer or mountain lion habitat, including oak woodlands; habitat for rare and endangered, threatened, and fully protected species; wildlife corridors and urban trails wetlands; aquatic habitat for spawning and rearing of anadromous salmonids and trout species; and riparian areas. The program has $2 million available annually.

State Water Resources Control Board's Proposition 204 Funds: Proposition 204 provides up to $27.5 million in loans and up to $2.5 million in grants for drainage water management units. Proposition 204 also provided $14.5 million for one-time grants to address restoration projects in watersheds tributary to the Trinity River. Eligible applicants include counties in these watersheds, joint power authorities with those counties, and, in specified cases, local public agencies.

Coastal Conservancy programs: Coastal Conservancy (Conservancy) programs that can benefit coho salmon include:

- **The Resource Enhancement Program,** which provides capital funds and technical assistance for the preservation, enhancement, and restoration of wetlands, watersheds, riparian corridors, and other wildlife habitat lands, including, where necessary, acquisition of interests in land and project design;
- **The Site Reservation Program**, which provides capital funds and technical assistance to safeguard significant coastal resource sites and responds to opportunities to acquire such sites when other agencies are unable to do so;
- **The Coastal Restoration Program**, which provides capital funds and technical assistance to ameliorate conditions that are preventing orderly development in accordance with the provisions of local coastal programs.

The Nonprofit Organizations Assistance Program: The nonprofit organization assistance program provides capital funds and technical assistance to nonprofit land conservation organizations to aid them in implementing Conservancy projects and in developing cost-effective local management of resource land and public access facilities. The Conservancy has joined in partnership endeavors with more than 100 local land trusts and other nonprofit groups.

Sustained Yield Plans for forest landowners: BOF requires landowners over 50,000 acres to develop a plan that demonstrates the continual flow of high quality forest products. The Department supplies support to CDF for technical analysis whenever the landowner wishes to incorporate protection measures for endangered species or candidates such as anadromous fish.

California Department of Forestry and Fire Protection's Forest Stewardship Program: The Forest Stewardship Program is supported by funds from the USFS's Local Assistance Program. The program provides grants to develop forest "stewardship" plans. In addition to improving forest resources and addressing fire safety, the purpose of stewardship plans is to identify resources, such as wildlife, fisheries, and threatened and endangered species

for improved management. Recently, the focus of the program has changed from individual landowners to assisting the development of community-based watershed plans.

Commercial and Recreational Fishing

Federal Ocean Fisheries Management

California's ocean salmon fisheries are managed by the PFMC under authority of the Federal Magnuson-Stevens Fishery Conservation and Management Act of 1975. The Pacific Coast Salmon Plan provides the basis on which the PFMC manages the salmon harvest in fisheries occurring 3 to 200 miles offshore, from the Canada border south to Mexico.

The PFMC manages California's natural and hatchery coho salmon stocks together with Columbia River and Oregon stocks as components of the Oregon Production Index (OPI) area. The fish from these stocks are essentially intermixed in the ocean fishery, and contribute to the harvest off the southern Washington coast, as well as to that off Oregon and California. The OPI is a measure of the annual abundance of three-year-old coho salmon, and currently is the sum of: 1) ocean sport and troll fishery impacts south of Leadbetter Point, Washington; 2) Oregon and California coastal hatchery returns; 3) Columbia River in-river runs; 4) Oregon Coastal Natural (OCN) spawner escapement; and 5) Oregon coastal inside fishery impacts. Most of California production is from hatcheries, which provide a very small portion of the total hatchery production in the OPI area.

When harvest impacts are modeled and regulations are developed for the management areas south of Cape Falcon, Oregon, consideration must be given to the mandates of Amendment 13 of the Pacific Coast Salmon Plan, to recommendations of the OCN Coho Work group, and to jeopardy standards established by the NMFS for listed ESUs. The standards specify levels of incidental take that are not likely to jeopardize the continued existence of the ESU. Within the naturally-produced OPI area coho salmon stocks, NMFS has identified and set jeopardy standards for three ESUs listed as threatened: CCC Coho ESU, SONCC Coho ESU, and Oregon Coast Coho ESU (OC Coho ESU).

Key coho salmon management objectives that shaped the 2001 Federal ocean salmon regulations are:

- Prohibit retention of all coho salmon off California, for the purposes of protecting CCC coho (NMFS jeopardy standard).

- A marine exploitation rate no greater than 13% on Rogue River/Klamath River (R/K) hatchery coho salmon, used as a surrogate stock for purposes of protecting SONCC coho (NMFS jeopardy standard).

- A combined marine/freshwater exploitation rate of no greater than 15% on OCN coho, which include both OC and SONCC coho, and comprise the largest natural component of the OPI (Amendment 13 of Pacific Coast Salmon Plan).

- A combined marine/freshwater exploitation rate no greater than 8% on OCN coho (OCN Coho Work Group recommendation).

Ocean Harvest Regulations

2001 ocean regulations include time and area closures, seasonal quotas, minimum sizes, specific fishing gear restrictions, and allowable take (e.g. daily bag and possession limits). The regulations also structure the south of Cape Falcon fishery to minimize OCN coho impacts while utilizing harvestable chinook and hatchery coho salmon stocks (PFMC 2001b). Retention of coho salmon is prohibited for the commercial troll and recreational fisheries south of Cape Falcon, except for a mark-selective recreational fishery off of Oregon of up to 55,000 coho salmon originating from that state's hatcheries; these fish are distinguished by healed adipose-fin clips.

Each Pacific coast state is required to conform its fishing regulations for ocean waters under their jurisdiction (within three miles of shore) to those implemented for adjacent Federal ocean waters, or risk pre-emption of their management authority by NMFS. California's commercial and recreational ocean salmon fishing regulations are presented in Appendices E1 and E2.

Inland Sport Fishing Regulations

California's inland fishing regulations are set under authority of the Commission (FGC, Division 1, Chapter 2, Article 1) (CFGC 2002). These regulations are reviewed and revised every two years during even-numbered years. In every odd-numbered year, the Commission devotes its early August, October, November, and December meeting to recommendations for changes in the sport fishing regulations.

Current regulations (Appendix E3) continue specific protection for coho salmon instituted in 1998, which state that "silver [coho] salmon are fully protected, and may not be taken in any of the waters of the State. Incidentally hooked silver [coho] salmon must be immediately released unharmed to the waters where they are hooked". Restrictions on seasons and area closures intended for other salmonid species may also reduce incidental take of coho salmon.

Effects of Management

Under the PFMC-adopted 2001 management measures for Federal ocean waters, all of the key coho salmon management objectives are satisfied. In modeling the impacts of the regulations for non-retention and mark-selective coho salmon fisheries, mortality resulting from hook-and-release, drop-off before being boated, and non-compliance is accounted for. The resulting projected non-landed mortality for the 2001 commercial and recreational fisheries south of Cape Falcon was estimated at 27,900 and 12,900 coho salmon, respectively (PFMC 2001b). As part of these impacts, the management components of the OPI that incorporate California's north coast coho salmon, the OCN and the R/K, were projected to sustain exploitation rates of 7.4% (3,475 fish) and 3% (1,504 fish), respectively (Table 23). The rate for OCN coho is below the 8% limit recommended by the OCN Coho Work Group and the 15% under Amendment 13, and the rate for R/K hatchery coho salmon, a surrogate for the SONCC Coho ESU stock, is well below the 13% NMFS jeopardy standard.

Table 23. Projected 2001 coastwide Oregon Coast Natural and Rogue/Klamath coho salmon harvest mortality and exploitation rates (PFMC 2001b).

Fishery	Oregon Coast Natural		Rogue/Klamath	
	Mortality (#)	Expl. Rate (%)	Mortality (#)	Exp. Rate (%)
SOUTHEAST ALASKA	15	0.03	0	0.00
BRITISH COLUMBIA	2	0.00	0	0.00
PUGET SOUND/STRAITS	82	0.17	0	0.00
BUOY 10	98	0.21	63	0.13
ESTUARY/ FRESHWATER	444	0.94	---	---
NORTH OF CAPE FALCON				
Treaty Indian Troll	318	0.68	0	0.00
Recreational	334	0.71	25	0.05
Commercial Troll	229	0.49	0	0.00
SOUTH OF CAPE FALCON				
Recreational				
Cape Falcon to Humbug Mt.	453	0.97	45	0.09
Humbug Mt. to Horse Mt. (KMZ)	186	0.40	632	1.27
Fort Bragg	117	0.25	337	0.68
South of Pt. Arena	173	0.37	97	0.20
Commercial Troll				
Cape Falcon to Humbug Mt.	825	1.76	52	0.10
Humbug Mt. to Horse Mt. (KMZ)	28	0.06	103	0.21
Fort Bragg	18	0.04	69	0.14
South of Pt. Arena	153	0.33	81	0.16
TOTAL	3,475	7.4	1,504	3.03

Research and Monitoring Programs

Many of the research and monitoring programs on coho salmon in California are outlined in Appendix F. These studies involve work on population estimation and monitoring, presence distribution, life history and habitat, and genetics. The work is conducted by several methods, using a variety of sampling equipment, from direct observation to electrofishing. Many of the sampling locations collect data on more than one life stage, or use different sampling techniques for the same age class. Studies of adults comprise approximately 30% of the monitoring and research programs listed in Appendix F. Most of the work focuses on the major stream drainages north of San Francisco.